JUNE, 1929

Railway Engineering and Maintenance

When 12% of the ties carried 100% of the creeping load

THE slotted angle bar was designed primarily for the purpose of anchoring joint ties, a method which was inadequate as well as destructive, as only 12% of the ties carried the creeping load.

In modern maintenance, tracks are anchored with FAIR Rail Anti-Creepers placed against 30% to 40% of the ties, thus assisting or entirely relieving joint ties of longitudinal loads.

THE P. & M. CO.

Railway Exchange Chicago

New York London Calcutta Montreal Paris Sydney

the FAIR Rail Anti-Creeper

—And They Are Good For Another Year

ILLUSTRATION shows one of the HY-CROME Spring Washers recently inspected after 14 months of service on one of the busiest main tracks in the country.

All were found in perfect condition—apparently good for another year of dependable service.

This is but one of the many test installations which have demonstrated that HY-CROME possesses a greater reactive range than ordinary spring washers.

The rapidly increasing demand for HY-CROME is convincing evidence that its non-fatiguing qualities insure greater rail joint protection at a lower cost per mile.

Has your road made a test?

The Reliance Manufacturing Company
Massillon, Ohio
Address Dept. M.E.

HY-CROME

"The Most of the Best for the Least"

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1916, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.
Alphabetical Index to Advertisers, Page 70 Classified Index to Advertisers, 66-68

PERFECT SEATING

That Assures Correct Gauge

THIS cross section shows how uniformly the Lundie Plate seats itself on the tie.

The plate compresses without cutting a single fibre of the tie and develops a hardened glazed wear resisting surface.

The bottom of the tie plate provides a series of at least 10 rounded steps of resistance, giving tremendous holding power against plate movement and consequent spreading of track. All this is accomplished without sacrificing any tie life through the use of destructive cutting projections.

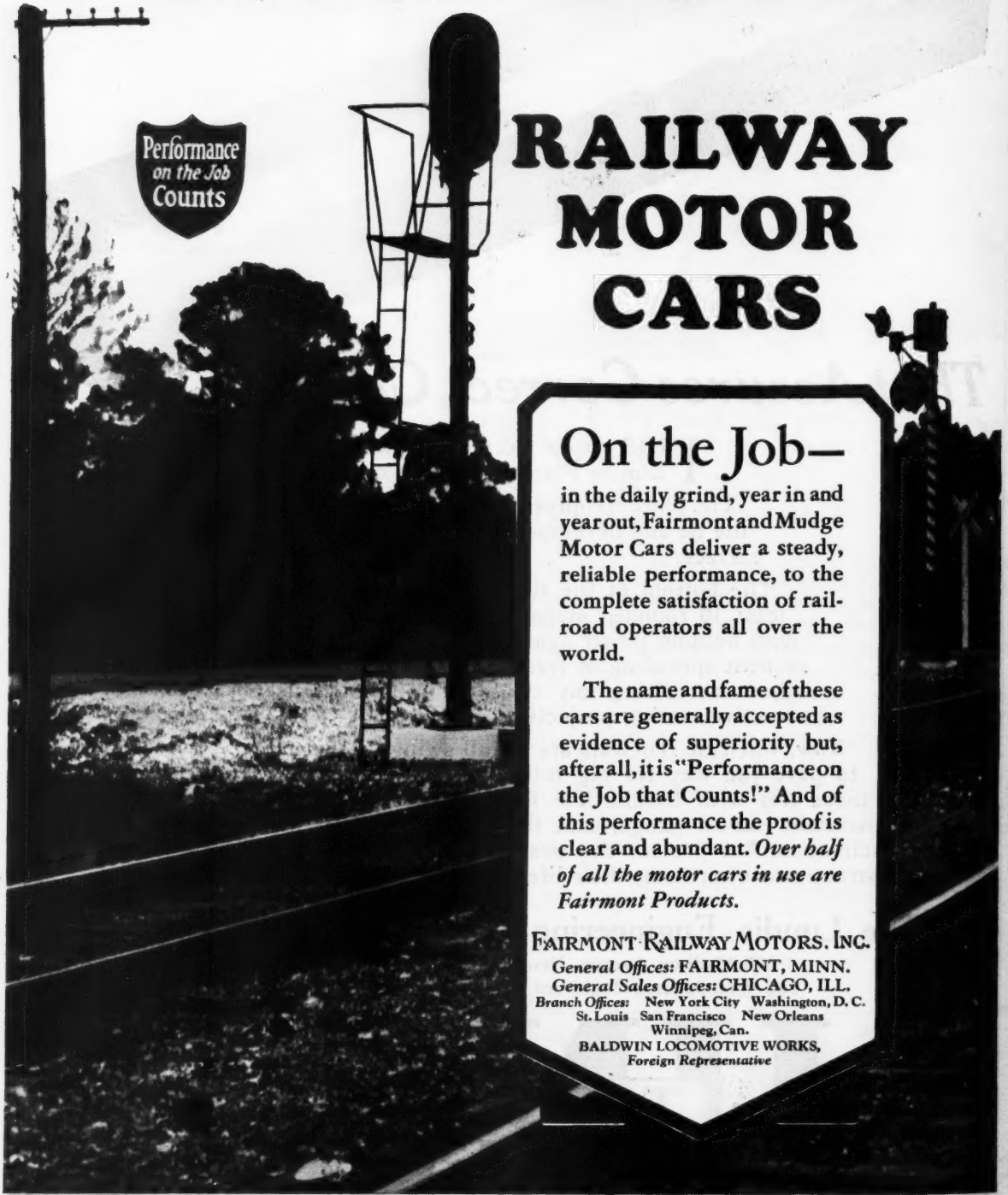
Now, when tie renewals are in full swing, is the time to pave the way for big future economies. Protect these ties with Lundie Tie Plates. They not only maintain correct gauge, cant the rail at the desired inclination, but protect the ties against mechanical destruction and prolong their life in track.

The Lundie Engineering Corporation

285 Madison Avenue, New York
166 West Jackson Boulevard, Chicago

LUNDIE TIE PLATE

Fairmont



RAILWAY MOTOR CARS

On the Job—

in the daily grind, year in and year out, Fairmont and Mudge Motor Cars deliver a steady, reliable performance, to the complete satisfaction of railroad operators all over the world.

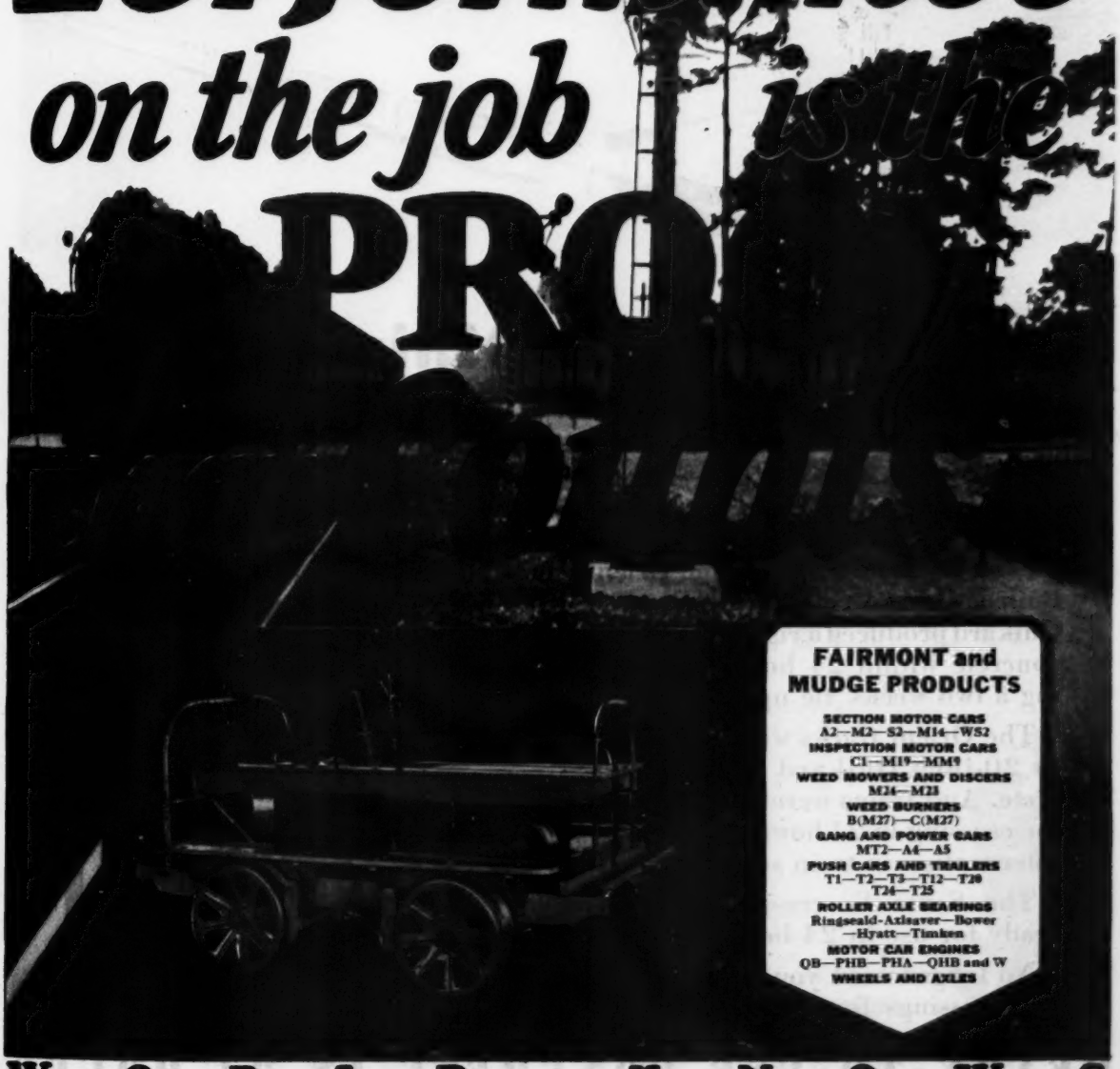
The name and fame of these cars are generally accepted as evidence of superiority but, after all, it is "Performance on the Job that Counts!" And of this performance the proof is clear and abundant. *Over half of all the motor cars in use are Fairmont Products.*

FAIRMONT RAILWAY MOTORS, INC.
General Offices: FAIRMONT, MINN.
General Sales Offices: CHICAGO, ILL.
Branch Offices: New York City Washington, D. C. St. Louis San Francisco New Orleans Winnipeg, Can.
BALDWIN LOCOMOTIVE WORKS,
Foreign Representative

THE RAILROAD

AND Mudge

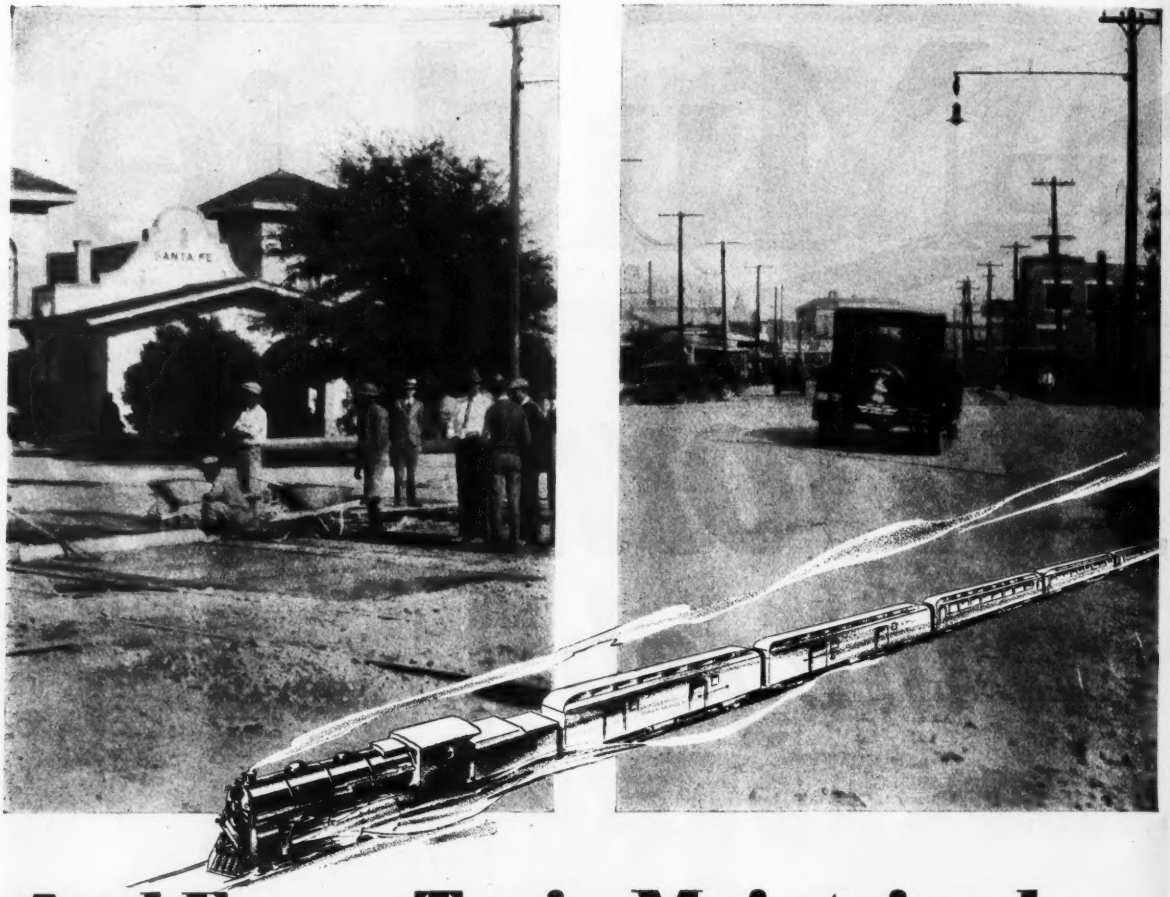
Performance on the job is the PROOF



FAIRMONT and MUDGE PRODUCTS

SECTION MOTOR CARS
A2—M2—S2—M14—WS2
INSPECTION MOTOR CARS
C1—M19—MM9
WEED MOWERS AND DISCERS
MJ4—MJ3
WEED BURNERS
B(MJ7)—C(MJ7)
GANG AND POWER CARS
MT2—A4—A5
PUSH CARS AND TRAILERS
T1—T2—T3—T12—T20
T24—T25
ROLLER AXLE BEARINGS
Ringsealed-Axlesaver—Bower
—Hyatt—Timken
MOTOR CAR ENGINES
QB—PHB—PHA—QHB and W
WHEELS AND AXLES

W O R L D K N O W S



And Every Train Maintained Its Schedule

NO need for "slow orders" on these two new concrete railroad crossings at San Angelo, Texas. All schedules on both the Santa Fe and Orient Railroads were maintained. Because Quikard produced a rigid, serviceable concrete within 24 hours, eliminating a two weeks' tie up.

The Orient tracks were embedded in 20-inch Quikard Cement concrete. And trains were running over the crossing in 24 hours without any interruption in train schedule.

The Santa Fe crossing was also ready for use in 24 hours.

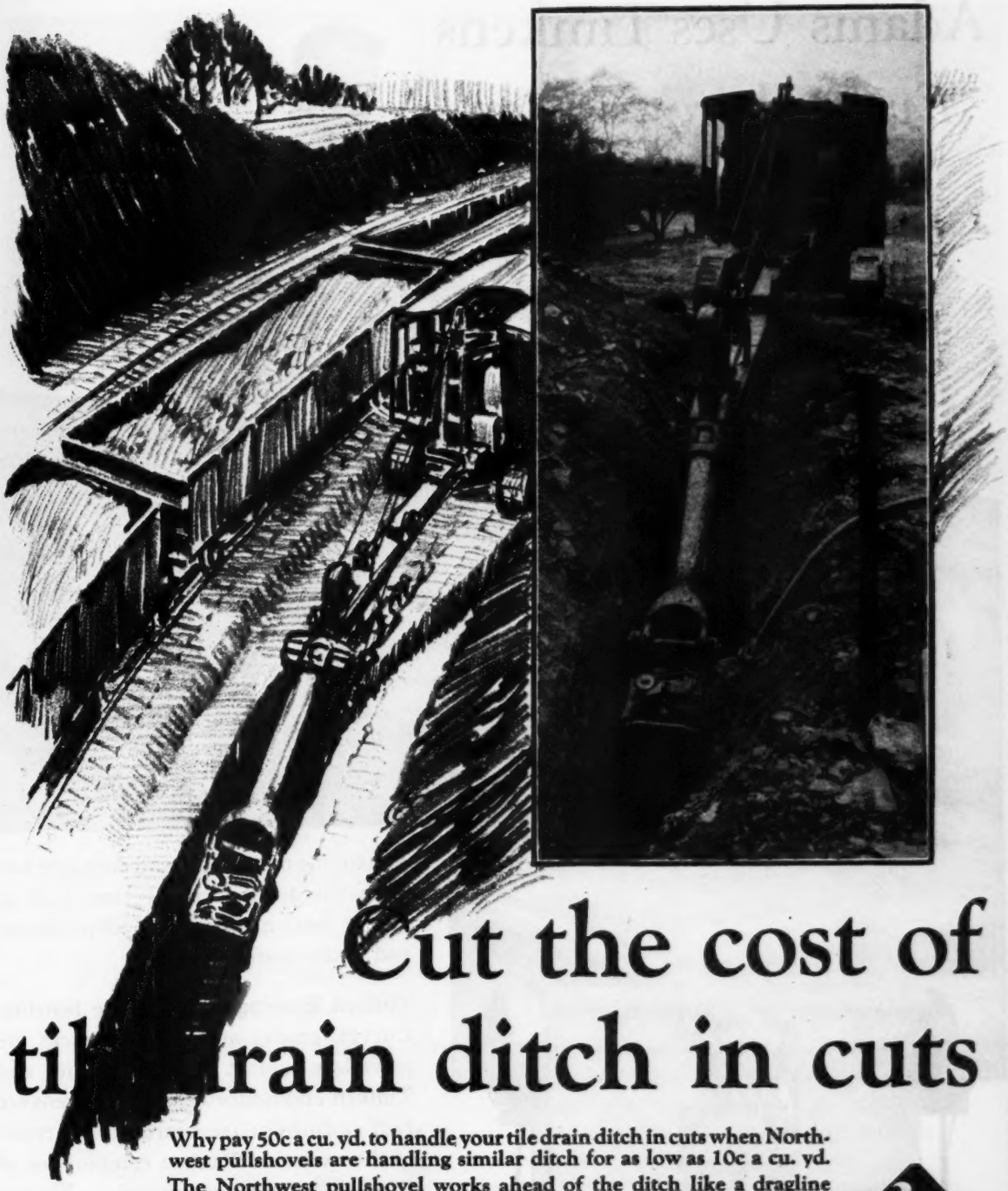
No longer need you block important crossings for extended periods —provided you use Quikard. As a highly refined Portland Cement, it sets normally, requires no admixtures. *It's the most plastic cement on the market!*

Use Quikard Cement in your turntable bases, crossings, bridges, culverts, freight-house pavements—and save time and labor on every job. Write for complete information.

Produced Only by
ASH GROVE LIME & PORTLAND CEMENT CO.
Founded in 1882
KANSAS CITY, MISSOURI OMAHA, NEBRASKA
District Sales Office: Oklahoma City, Okla. (295)

QUIKARD CEMENT

READY-TO-USE CONCRETE IN 24 HOURS



Cut the cost of tile drain ditch in cuts

Why pay 50c a cu. yd. to handle your tile drain ditch in cuts when Northwest pullshovels are handling similar ditch for as low as 10c a cu. yd.

The Northwest pullshovel works ahead of the ditch like a dragline but digs a straight walled trench of any depth up to 27 ft. It can dig its own footing along the edge of the right-of-way and load to cars and set pipe or drain, and when the job is through, change it back to a crane, dragline or shovel and put it on other work.

The Northwest is an all-purpose, all-year machine. Let us tell you about it.

NORTHWEST ENGINEERING CO.

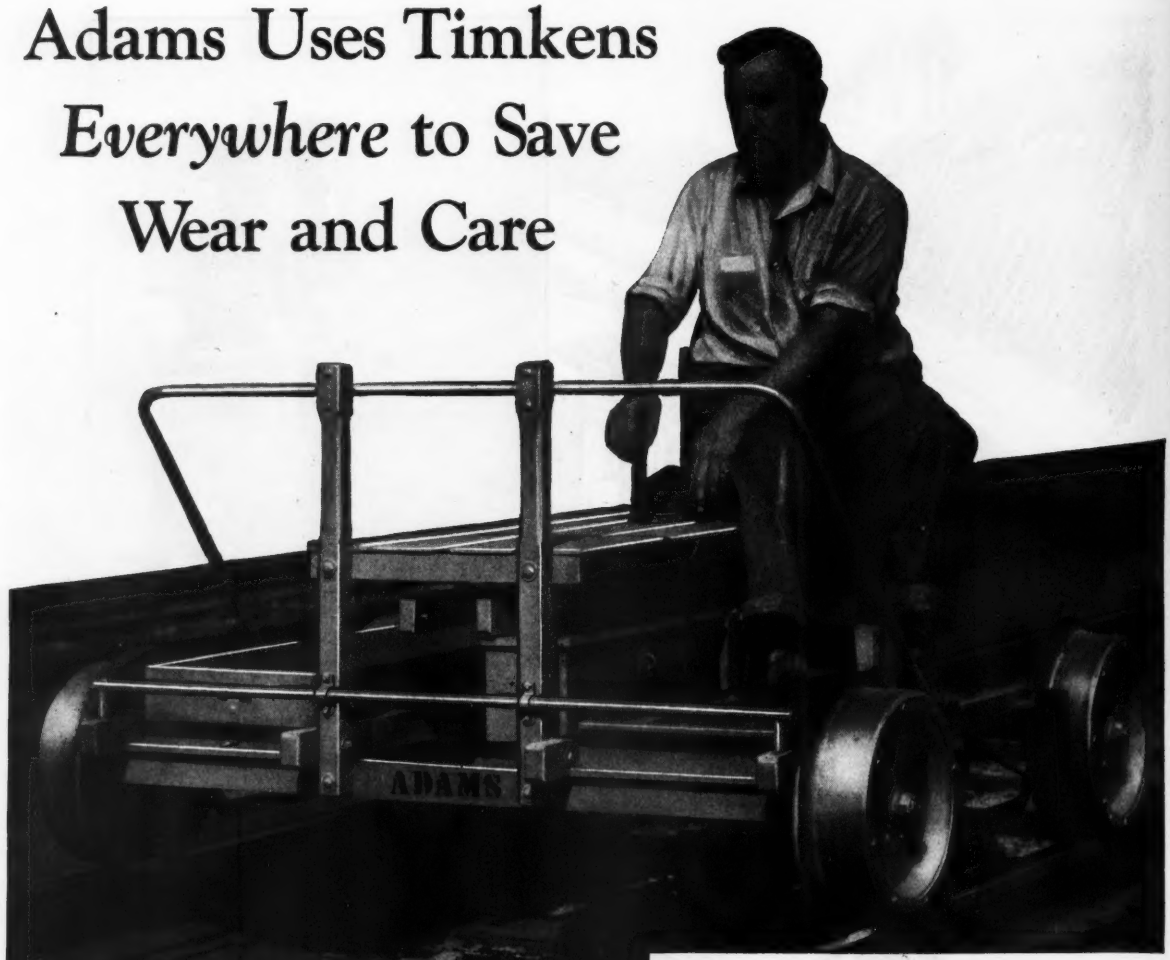
The world's largest exclusive builders of gasoline and electric powered shovels, cranes and draglines

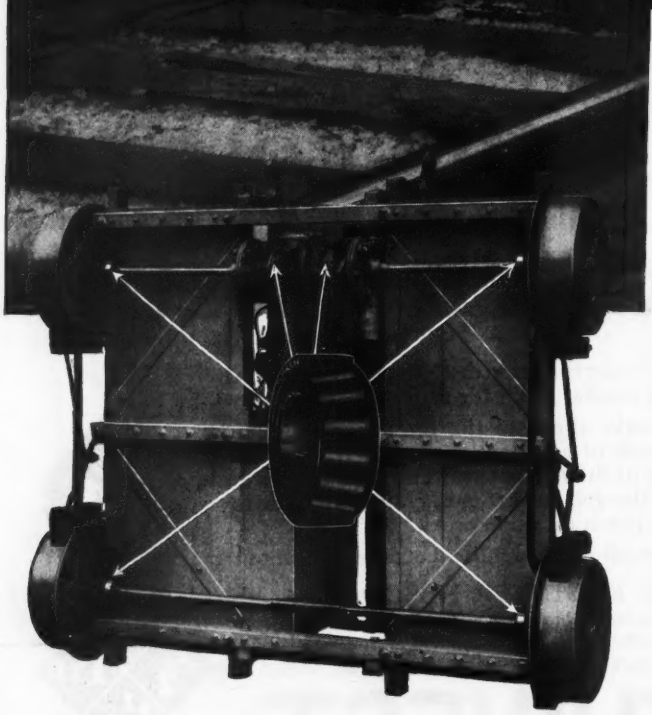
1725 Steger Building 28 E. Jackson Boulevard Chicago, Ill., U. S. A.

NORTHWEST

RE&M6—Gray

Adams Uses Timkens *Everywhere* to Save Wear and Care





The engine crankshaft and each axle box have the utmost protection against power loss, maintenance, depreciation and under-performance.

Timken Bearings bring these benefits. Curves, grades and uneven tracks are powerless against Timken rigidity and Timken endurance because Timkens are *full radial-thrust* bearings as a result of the exclusive Timken combination of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken-made steel. That means power saving, lubricant economy and investment-assuring *endurance!*

THE TIMKEN ROLLER BEARING CO.
C A N T O N , O H I O

TIMKEN *Tapered Roller* **BEARINGS**

Service that *Satisfies*

The formula for satisfying Spike and Bolt service is simple enough— . . . . .

To a thorough knowledge of track maintenance add an organization of experts in the production of steel products.

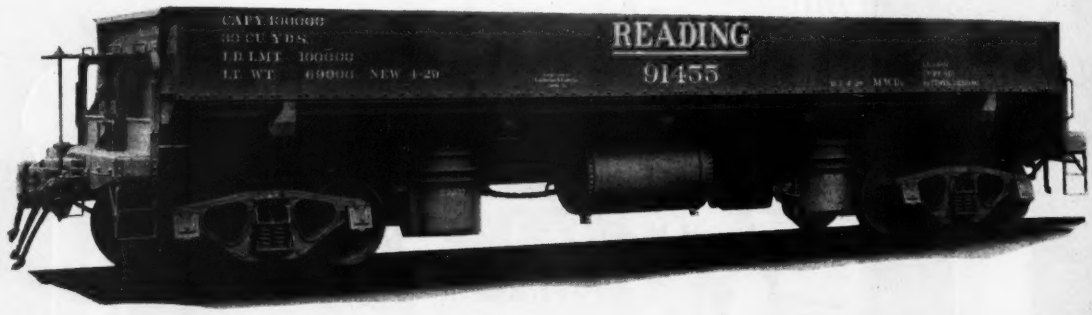
Combine with this adequate equipment carefully maintained, and painstaking inspection.

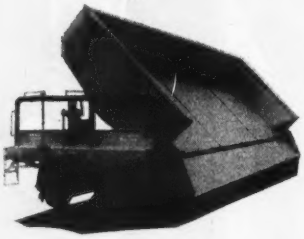
The result is a service that fulfills all requirements—the kind of service you expect to receive from the Illinois Steel Company.

Illinois Steel Company

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

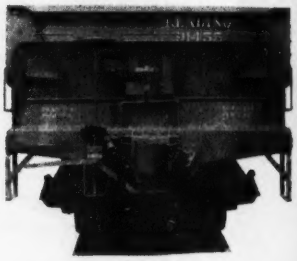
General Offices: 208 South La Salle Street, Chicago, Illinois





A car that delivers the goods—The Koppel RTD (Rolling Trunnion Type) dumps quickly—safely—cuts handling costs.

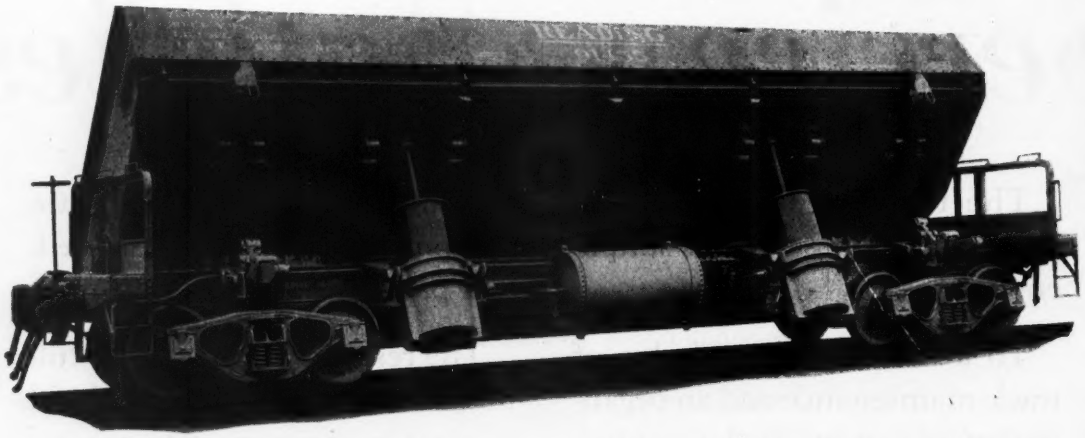
We invite comparative tests.

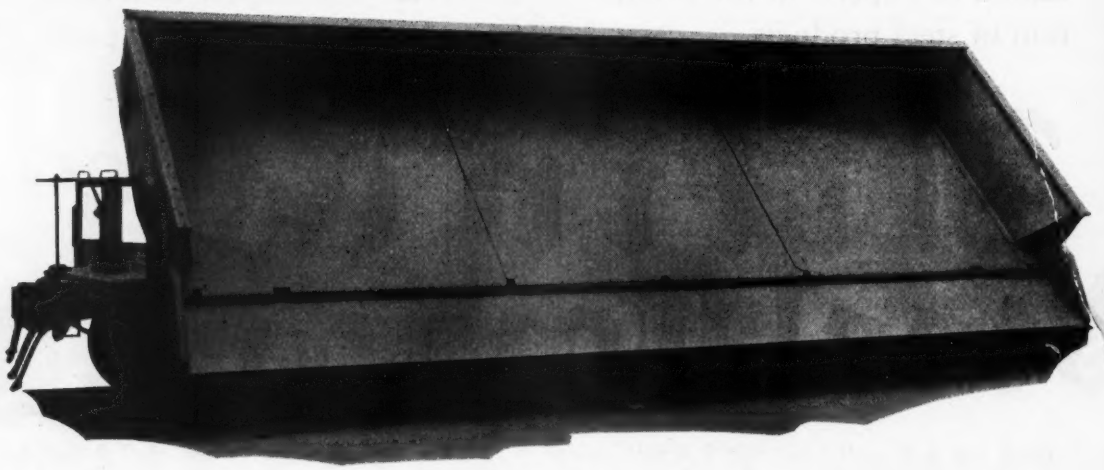


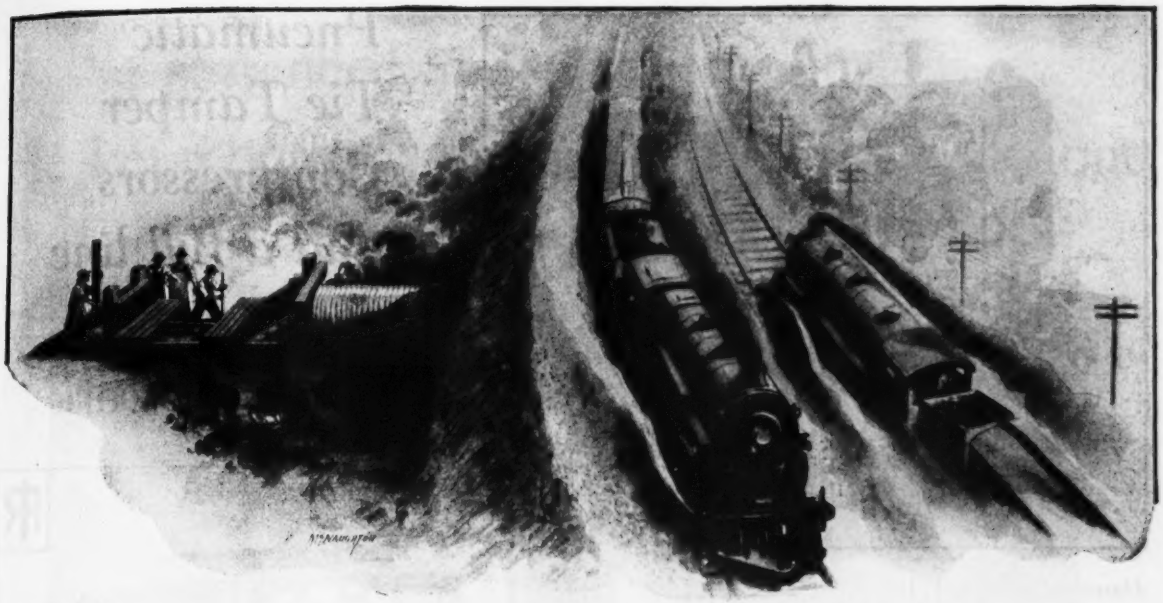
KOPPEL INDUSTRIAL CAR & EQUIPMENT COMPANY

KOPPEL, PENNA.

New York Chicago Pittsburgh San Francisco







No "Slow Order"

when this pipe went under ...the tracks

"ALL trains under Slow Order!" —that has been standard railroad practice for years when culvert or bridge replacements are being made under existing tracks.

But when above pipe was put in place, every train had a clear track for full speed ahead, not a moment's delay, not the slightest interruption to traffic.

This remarkable result was achieved by the use of the Armco Jacking Method of pipe placement. With this method the pipe is jacked through the fill so there is no trench, no falsework, no fill or subsequent settlement... and what is more, savings from 40 to 75 per cent as compared with ordinary installation costs. The experience of Armco engineers in culvert placing work is available to you on all Armco installations. Write us for the bulletin "Reducing the cost of Culvert Placement." No obligation.

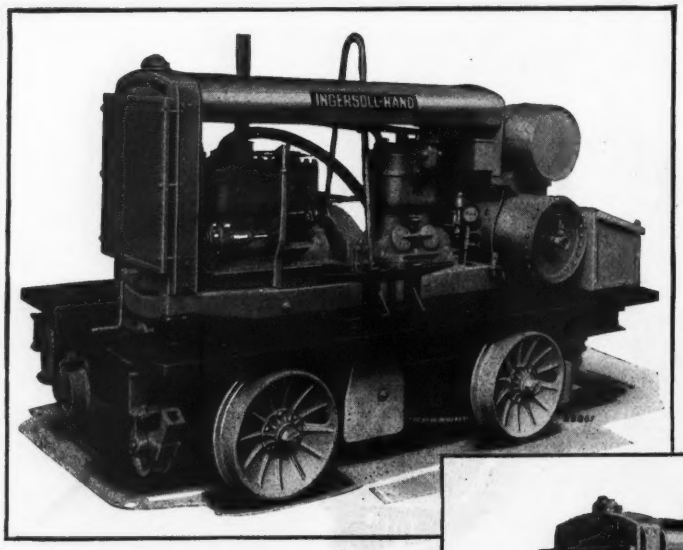
Armco culverts and drains are manufactured from the Armco Ingot Iron of the American Rolling Mill Company and always bear its brand

ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

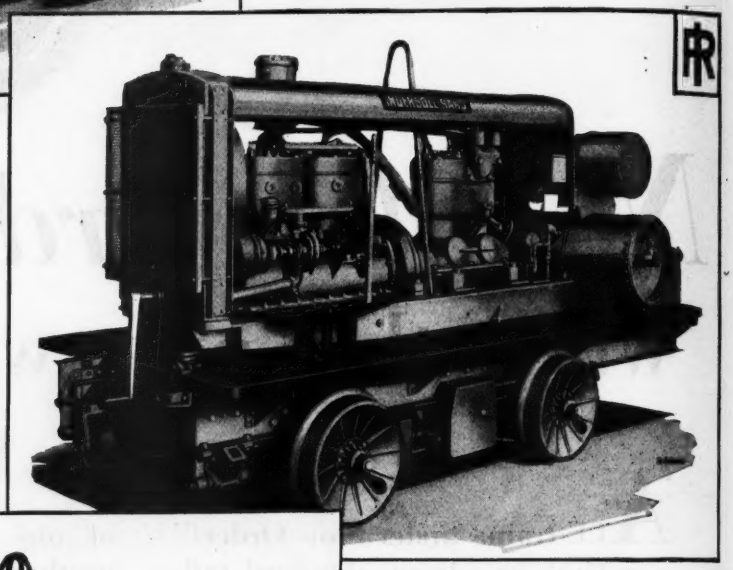
ARMCO *corrugated* PIPE

© 1929, A. C. M. A.

Pneumatic Tie Tamper Compressors and a full line of air tools for track work



Above—
4-Tool Tie Tamper Air Compressor
(*with self-propelling mechanism*)



At right—
8-Tool Tie Tamper Air Compressor
(*with self-propelling mechanism*)

At left—
12-Tool Tie Tamper Air Compressor
(*with self-propelling mechanism*)

Ingersoll-Rand Company
11 Broadway New York

Branches or distributors in principal cities the world over.

264-TT

Ingersoll-Rand

Stranded in a Small town . . . He kept both Engagements by Telephone

A PLANT superintendent of a large tire company was on a business trip in Canada. He missed his connection and was stranded in a town with one train a day. Two important engagements loomed ahead—one in Toronto, the other in New York. He thought of the telephone. He called the two cities. He completed his business so satisfactorily in both places that neither of the trips was necessary.

The telephone is always ready to put important things through. A man in St. Louis was too busy to go to Memphis and back. He made the round trip by telephone. It resulted in $1400 worth of business.

A Seattle lumber company received a carload order on condition that it could be shipped in five days. Special items had to be cut. A telephone call to Portland, costing $1.15, found a mill that could do the work. The car was shipped in time.

A Minnesota commission house invested $43.60 in nine Long Distance calls to five cities and sold 60 carloads—$24,840 worth—of potatoes.

What delay, worry or expense could you save today? Is there a misunderstanding to be adjusted, an important sale or purchase hanging fire? Calls are cheap.

Typical station to station day rates: Chicago to South Bend, 60c. Peoria to St. Louis, 90c. Cleveland to Philadelphia, $1.60. Pittsburgh to St. Louis, $2.35. Boston to Chicago, $3.25.

Out of town calling is quick and calling by number takes even less time. Bell Telephone Service. *Quick. Inexpensive. Universal.*

SELF-PROPELLED COMPRESSOR and "STRAIGHT BACK" TIE TAMPERS

On The Job

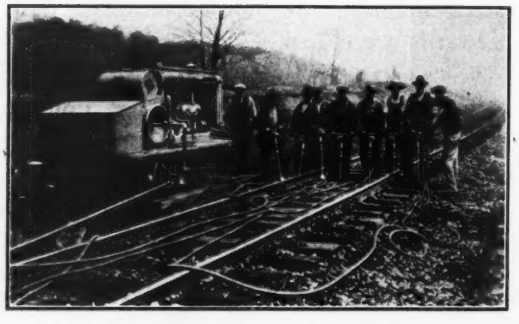
MANY railroads are using these units because of their convenience, speed and reliability. The standard CP Compressor is mounted on a truck frame carrying flanged wheels with Timken roller bearings, transverse shifting wheels and winch, air-operated lifting jacks, lifting bale and a roomy tool box. The gasoline engine that operates the compressor also propels the car at a speed of 12 to 18 miles per hour, depending upon its size. The compressor is furnished in sizes of 110, 160, 220, 265 and 310 cu. ft. per minute displacement. The CP Tampers have several interesting features that are fully described in folder No. 1646. Details of the Self-Propelled Compressors are given in Bulletin No. 789.

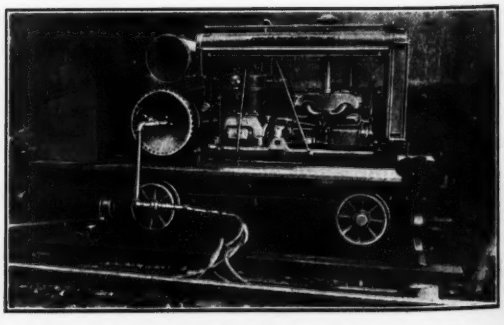
Chicago Pneumatic Tool Company

Railroad Department

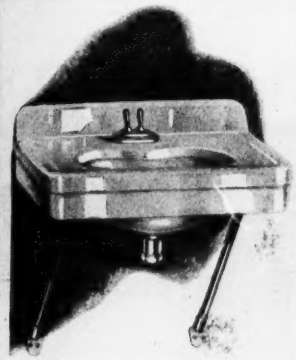
6 East 44th Street, New York
1004 Mutual Bldg., Richmond, Va.
175 First Street, San Francisco
310 S. Michigan Ave., Chicago

J-293





The responsibility of ▲ ▲ ▲ Leadership *



YELLOWSTONE

GLACIER

Quality is the prerequisite to quantity production. It is only because the **Standard Sanitary Mfg. Co.** has never been content to rest upon a good record and has ever sought to improve its own fine products that more "Standard" Plumbing Fixtures are in use than any other kind. They are preferred for homes, hotels, hospitals, office and industrial buildings, steamships and railway cars.

Today quality in plumbing fixtures includes distinctiveness of design and color, as well as fine material and workmanship. In fact, distinctiveness is the order of the day, not only in wearing apparel and kitchen utensils, in art and architecture, but also in transportation. There is more leisure for travel, and more travelers are demanding service that is both comfortable and pleasant.

Would plumbing fixtures of genuine vitreous china add a note of distinction to your service? Could you achieve an individuality in each car by installing genuine vitreous china plumbing fixtures in color? Certainly the subject warrants investigation. And "Standard" is ready to cooperate with you. All "Standard" Plumbing Fixtures designed especially for railway use are now available in these new colors: Ming Green, T'ang Red, Clair de Lune Blue, Ivoire de Medici, Meissen White, Ionian Black, Royal Copenhagen Blue, Rose du Barry, Orchid of Vincennes, and St. Porchaire Brown.

If you are interested in the possibilities of color as a new decorative note for your featured trains, write for a chart of these new colors and catalogue of railroad plumbing fixtures.

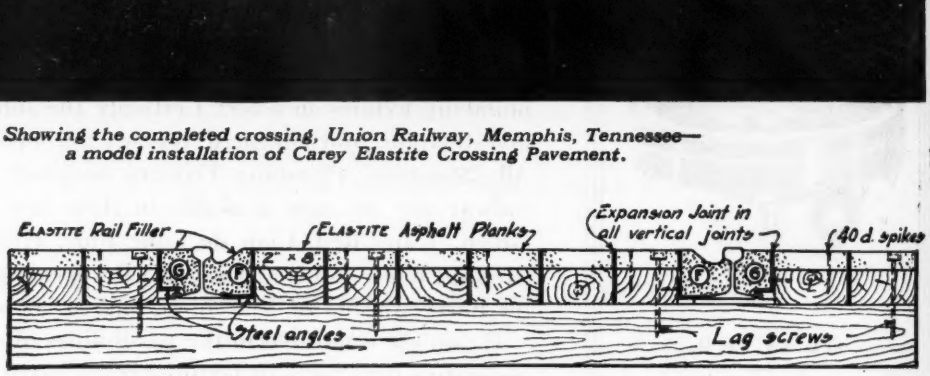
Standard Sanitary Mfg. Co.
Railway Fixture Department
PITTSBURGH

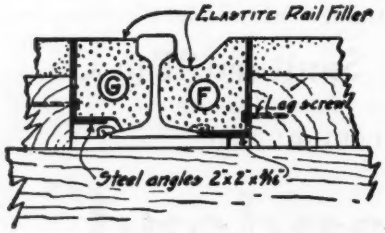
"Standard" PLUMBING FIXTURES

*THE LARGEST MANUFACTURER OF PLUMBING FIXTURES IN THE WORLD

Read how the Union this Memphis crossing

Showing the completed crossing, Union Railway, Memphis, Tennessee—a model installation of Carey Elastite Crossing Pavement.





CAREY Elastite Crossing Pavement consists of sections of Carey Elastite Rail Filler and Carey Elastite Asphalt Plank, both made from a fibrous asphaltic compound which traffic actually tends to keep in condition. The units—which arrive on the job cut to fit—can be installed in any weather. Especially adaptable on special steel-work crossings, with frogs and switches and angled cross-overs.

Railway made so smooth

...with a flooring that knits and heals in use and shock-absorbing "cushions" at the rails

TO guarantee a smooth passage over this Memphis crossing for years to come, the Union Railway surfaced it with Carey Elastite Crossing Pavement. To prevent pumping and disintegration at the rails, they used a unique asphalt rail filler, Carey-developed and Carey-prepared.

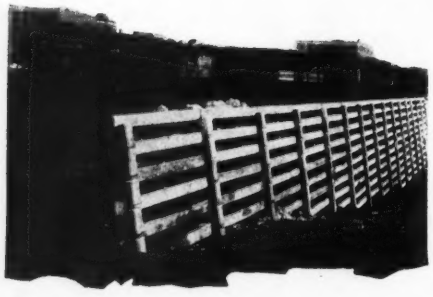
The work was done quickly and easily, at a moderate first cost. And the result is a frost-tight, water-excluding crossing of surprisingly long and efficient life. A smooth crossing that is winning the good-will of motorists—a quiet crossing that will require but little maintenance.

THE PHILIP CAREY COMPANY, *Lockland*, CINCINNATI, OHIO

Carey Elastite CROSSING PAVEMENT

Also manufacturers of: Carey Elastite Expansion Joint, Carey Elastite Trunking for Signal Wires, Carey Elastite Plank for Bridge Flooring, Carey Elastite Water-proofing Protection.

WHY



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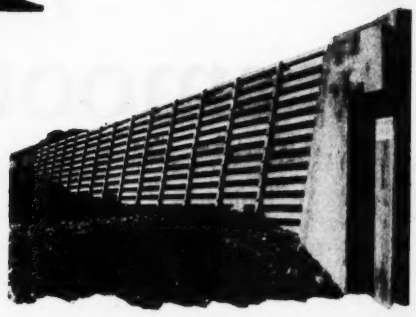


MASSEY

concrete cribbing walls

so often preferred to monolithic walls

35 roads have found the answer

?

in economy and convenience

Massey Concrete Products Corporation

PEOPLES GAS BUILDING, CHICAGO, ILLINOIS

Sales Offices: New York Atlanta Cincinnati St. Louis Los Angeles

Canadian Concrete Products Co., Limited, Transportation Building, Montreal, Que.

WHEN price is the determining factor in the sale of railway motor cars—there's a reason!

Price represents design, materials, construction, factory overhead and a fair profit. Of these elements factory overhead and profit must be maintained or the maker goes out of business. From where then, comes the cheap motor car? The only chance to reduce price is by reducing factory cost of design, materials and construction at the ultimate expense of the purchaser.

The Sheffield policy is to furnish a car of lowest operating costs and longest life. Therefore, "Sheffield" cannot always be "cheap" in first cost.

FAIRBANKS-MORSE

TIMKEN BEARING EQUIPPED

F M

MOTOR CARS

First on the rails
—and still first

FAIRBANKS-MORSE MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

A standard of value for 33 years

1896

"Sheffield" set the standard value for railway motor cars in 1896 with the first motor car on rails.

Practically every important motor car development since, that has established the trend in design and saved railroads time and money, has been contributed by Sheffield research and engineering.

Unlimited capital has always enabled Sheffield to give motor car users the benefit of quantity purchases of high grade materials at the low market price.

America's most completely equipped railroad motor car factory manufactures this quality stock in Sheffield advance designs at a low cost to railroads.

And a further saving is made from the performance of the car itself.

Service records on many important railroads in the United States prove that Sheffields have cost less than half as much to operate and maintain as any other car for similar service.

FAIRBANKS, MORSE & CO., *Chicago*

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations

FAIRBANKS-MORSE

MOTOR CARS

TIMKEN BEARING EQUIPPED

F M

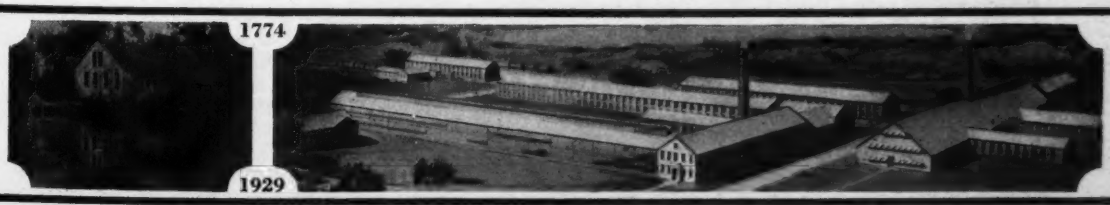
RA 21.59

Real value for track work
Genuine O. Ames

Good steel, good handles are not enough. The tool that lightens the track worker's task will produce more work for you. It's the easy lift, full swing, clean load and a grip that has all day comfort that is made possible with the famous Ames Bend and the new Ames R-MOR-D handle. This is the real value for you, every day your men use genuine O. Ames shovels.

The complete "All Star" Ames line includes the genuine O. Ames Four Star, the Ames 3 Star and the Ames 2 Star, to meet every need. It will pay you to "look for the stars" on every shovel you buy.

More Ames Shovels are used than any other kind



AMES SHOVEL AND TOOL COMPANY
NORTH EASTON MASSACHUSETTS
ST. LOUIS, MISSOURI - - - ANDERSON, INDIANA

2879

THE RIGHT TYPE OF CAR

By Casey

THE PROPER CLASSIFICATION AND USE OF MOTOR CARS IS THE MOST IMPORTANT STEP IN REDUCING THE COST OF OPERATION AND INCREASING THE EFFICIENCY OF ALL CARS.

Casey-Jones HAS RECOGNIZED THIS FACT AND HAS DESIGNED AND BUILT EVERY CAR FOR A DISTINCT CLASS OF SERVICE --- EVERY CAR A LEADER IN ITS CLASS.

EVERY Casey-Jones ENGINE AND CAR IS CORRECTLY RATED FOR POWER AND IS PROPERLY DESIGNED FOR THE SERVICE FOR WHICH IT IS BUILT.

NORTHWESTERN MOTOR COMPANY

FOR EVERY CLASS OF SERVICE

Jones

REG U.S. PAT. OFF.

AND REMEMBER THIS ---

THAT EVERY Casey Jones CAR IS FULLY GUARANTEED TO BE OF STANDARD QUALITY. WHOLLY CAPABLE FOR THE PURPOSE FOR WHICH IT IS BUILT --- AND THE BEST INVESTMENT AT ANY PRICE --- LOWEST COST PER MILE --- FOR YEARS AND YEARS.

THE RIGHT TYPE OF CAR FOR EVERY CLASS OF SERVICE

CLASS	TYPE		H. P.	CAPACITY	SERVICE
CLASS A	Casey Jones	551	22	4 TO 150 MEN -- TRAILERS	HEAVY DUTY
CLASS A	Casey Jones	551-H	22	20 MEN	HUMP SERVICE
CLASS A	Casey Jones	551-D	22	8 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS A	Casey Jones	555	22	10 MEN -- ENCLOSED	OFFICIAL INSPECTION
CLASS BB	Casey Jones	523	8	2 TO 60 MEN -- TRAILERS	EXTRA LARGE SECTION
CLASS B	Casey Jones	521	6	2 TO 30 MEN -- TRAILERS	STANDARD SECTION
CLASS C	Casey Jones	531	4	1 TO 4 MEN	LIGHT INSPECTION

MODERN MOTOR CAR EQUIPMENT FOR EVERY PURPOSE

DISCER	Casey Jones	581	22	ALL DISCING WORK	BALLAST IMPROVEMENT
TRAILER	Casey Jones	552		24 MEN SEATED	MOVING LARGE GANGS
PUSH CAR	Casey Jones	500		6000 POUNDS	WORK CAR

MOTOR CAR FRAMES AND CHASSIS OF ALL TYPES - SPECIAL MOTOR CARS - MOTOR CAR ENGINES 4-6-8 HORSEPOWER - REPLACEMENT AXLES AND BEARINGS - MOTOR CAR SUPPLIES

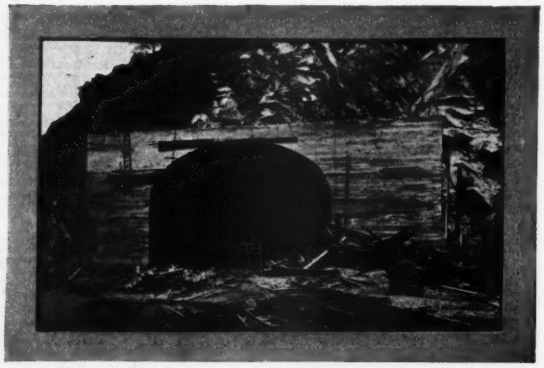
HYATT - TIMKEN AND BOWER ROLLER BEARINGS

Factory and General Offices: Eau Claire, Wis.

Blasting a right of way by time table

New York Central adds new trackage on main line between Storm King and Manitou

FOR more than a year the New York Central has been building a new right of way between Storm King and Manitou on the east bank of the Hudson River as part of the new four-track system between New York City and Albany. Within a few feet of the present track, tons of rock are being blasted away, yet without a single passenger being as much as aware of the operations. Cliffs are being cut away and tunnelled through only a few feet from the 125 to 130 trains that speed by every day. Great care must be used in determining the burden, height of slope, stratification and type of rock. All drilling is done at night, holes only 10 to 20 feet deep spaced 3 to 4 feet apart and loaded with just enough dynamite to displace the rock in such condition that as little secondary shooting as possible will be needed. Only two shots a day are permitted. In the morning the section farthest from the tracks is shot, twenty minutes being allowed for clearing the adjacent tracks. At noon the face of the cliff close to the tracks is shot and thirty minutes allowed for the blast and clearing.



South portals of the Storm King tunnels—the old one at the right. The facing on the new tunnel has just been finished

Operations are roughly divided into four parts:

(1) Enlarging the Garrison tunnel to a width of 38 feet and a height of 26 feet and widening the right of way to the north of it by removing a point of rock 85 to 90 feet high. This involves the removal of approximately 40,000 cubic yards of rock.

(2) Driving a two-track tunnel parallel to and

E. I. du Pont de Nemours & Co., Inc.
Explosives Department
WILMINGTON, DELAWARE

An interior view of the Garrison tunnel showing the drill car equipped with four drills, which was used to enlarge the tunnel to a width of 38 feet and a height of 26 feet

west of the old Breakneck tunnel and enlarging the latter so that both the old and new tunnels will be the same size as the Garrison tunnel. Some 40,000 cubic yards of rock will be removed in this operation.

(3) Widening the cut north and south of Cold Spring for a distance of five to six miles to permit the laying of two additional tracks. 30,000 cubic yards of rock were removed in this cut.

(4) Widening the right of way between Garrison and Manitou to allow for four tracks through a ledge of rock which rose to an average height of from 60 to 65 feet for a distance of 5,000 or more feet.

In all, 800,000 to 900,000 cubic yards of rock must be removed. About six hundred thousand pounds of du Pont dynamite will be used.

This is the second largest project the Walsh Construction Company of Davenport, Iowa, has undertaken for the New York Central. The first was the Castleton, New York, cut-off completed several years ago. Du Pont explosives were also used on this project. The Walsh Construction Company is one of the largest railroad contracting organizations in the United States. H. C. Kahl is directing operations from the Company's field office at Garrison.

There is an important significance in the frequent association of du Pont explosives and explosives service with America's most important engineering projects.

The old Breakneck tunnel is at the left. A train of dump cars is entering the north portal of the new tunnel which was being driven at the time this picture was taken

DU PONT
REG. U. S. PAT. OFF.

Use the Improved Jordan Railway Track Oiler

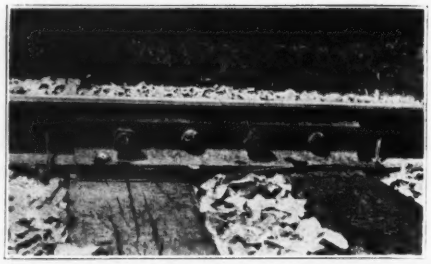
for Economical and Proper Application of Oil to Railway Track Structure

JORDAN RAILWAY TRACK OILER

Manufactured By

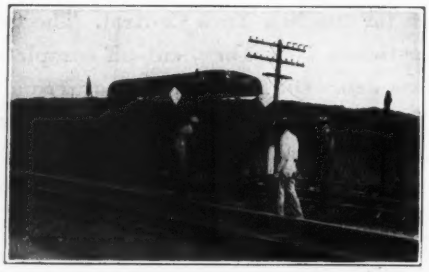
O. F. JORDAN CO.

EAST CHICAGO INDIANA



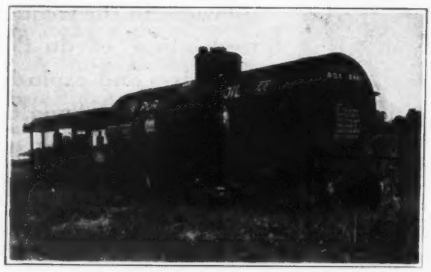
AUTOMATICALLY OILS RAIL JOINTS AT A SPEED OF 8 MILES PER HOUR. JOINTS, BOLTS AND NUTS ARE THOROUGHLY COATED.

APPLIES PROTECTIVE COATING OF OIL TO ENTIRE RAIL AND FASTENINGS AT A SPEED OF 15 MILES AN HOUR USING 1 GALLON OF OIL A MILE FOR EACH POUND OF RAIL PER YARD.



JORDAN RAILWAY TRACK OILERS ARE EQUIPPED WITH HAND-OPERATED SPRAYS FOR OILING SWITCHES, FROGS, INTERLOCKERS, ETC.

APPLIES DUST-LAYING, WEED-KILLING COAT OF OIL OR OTHER COMPOUND TO ROAD-BED AT SPEED OF 6 to 8 M.P.H.



DRAWBAR PULL—VERY HIGH—ENABLES PULLING STANDARD TANK CARS FOR HEAVY OIL APPLICATIONS.

ELIMINATES USE OF LOCOMOTIVES ENTIRELY. PERFORMS OWN SWITCHING OPERATIONS WHEN NECESSARY.

—Self-Propelled
—Ruggedly Constructed
—Heavy Steel Wheels
—Roller Bearings
—Heavy Duty Mechanism
—Maximum Speed 25 M. P. H.
—Straight and Automatic Air Brakes
—Economically Performs Every Railway Track Oiling Function

Now Successfully Operating on Many Leading Trunk Line Railways

Leadership—*won through* Satisfactory Service

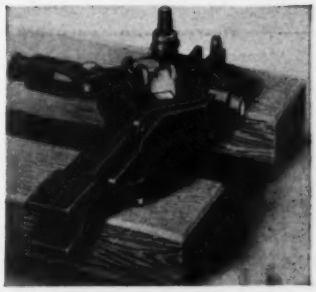
This entire Terminal Yard is equipped with Bethlehem New Century Switch Stands.

CONSTANT improvement keeps Bethlehem Switch Stands always in a position well in advance of the field. But these improvements always concern only details and never touch basic principles. The design of Bethlehem Switch Stands is fundamentally sound and embodies the sifted results of more than 60 years experience in building switch stands.

Every improvement in Bethlehem Switch Stands is developed in such a way that it can be applied to stands already in service at slight expense. Roads that standardize on Bethlehem Switch Stands are assured of having stands that can always readily be brought up to date.

Bethlehem Switch Stands are leaders. The best evidence of their leadership is the many railroads that standardized on them years ago and have continued to use them ever since.

Above: Bethlehem New Century Switch Stand for use with target or disc lamp. Adjustment of either switch point independent of the other is accomplished without disconnecting the stand from the switch.



Above: Bethlehem Parallel Throw Switch Stand Model 1222, for confined locations. The height of this stand from the top of the tie to the base of the lamp is only 4½ inches.

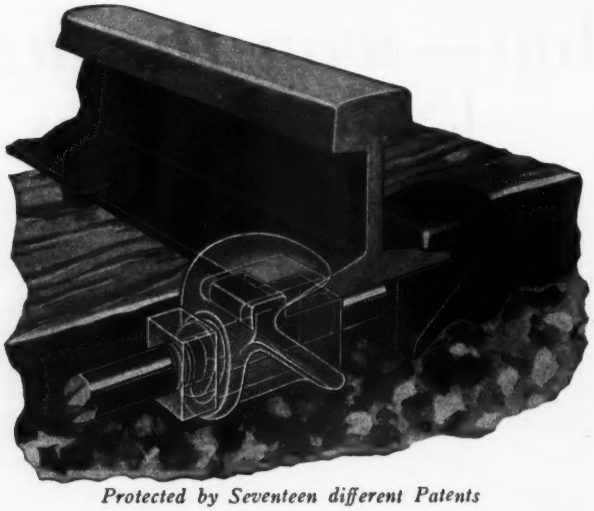
At left: Bethlehem Switch Stand Model 53-B, a super mainline switch stand of the parallel throw, gearless type, with an easy and powerful action. The upper part of the structure can be badly bent or even torn away without damage to the rest of the stand.

BETHLEHEM STEEL COMPANY
General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland and Honolulu.

BETHLEHEM

Five Devices In One



Protected by Seventeen different Patents

—all other methods of rail bracing made obsolete by Coover Braces—

Five distinct devices are included in the Coover Brace —A tie-rod—an anti-rail creeper—an anti-rail tilter—an anti-rail spreader—and a brace.

UNIVERSAL—one and the same brace fits equally well any size A S C E, —A. R. A. type A, or A. R. A. type B rail. Stockrooms need carry no surplus stock—For, one and the same Coover Brace can be used—without making a single change—on any rail section over your entire system.

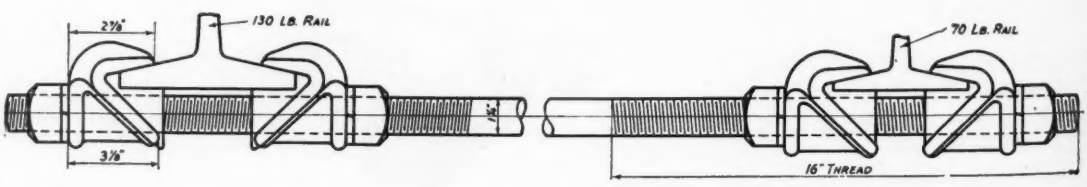
NO "sloppy fits" with the Coover Universal-two-piece clutches. The two jaws of each clutch operate just as the two jaws of a vise do, and grip flanges of rails with a "vise like grip".—A one piece clutch can only be used on rail for which it is intended—otherwise you have a "sloppy fit" and the proper hold is not obtained on rail.

TRUSSING rails by means of vise grip on both inside and outside flanges of both rails—simply applies a fundamental principle of construction to track building—causes one rail to bear the strain of the other—eliminates constant respiking and saves in labor, lengthens life of ties and prevents costly accidents.

Try Coover Braces where every other device has Failed.

ESPECIALLY RECOMMENDED FOR USE ON

CURVES - SWITCHES - WYES - TERMINALS - TIPPLES - YARD TRACK - ETC.



THE COOVER RAILROAD TRACK BRACE CO.

DAYTON, OHIO, U. S. A.

KREOLITE

Aerial View of Part of the Toledo Plant of The Jennison-Wright Company

Framing of Timbers "BEFORE" Treatment Is Essential

By the installation of the latest and most modern framing and boring machinery, we assure the purchaser of timbers most accurately framed at lowest cost.

The life of treated timber depends upon the character of the preservative used. *We distill our own Creosote oil.* By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired.

Enormous stocks of Railroad Cross and Switch Ties, Structural Timbers and Piling, in all sizes, of Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant, at Granite City, Ill. (East St. Louis).

THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

Branches in All Large Cities

R.R. TIES

Carry Off Water As Fast As It Falls—

RAILROAD yards present a large flat area that can accumulate a lot of water in a mighty short time.

But Toncan Iron drains can lead off water as it falls thus preventing soil saturation. They do this more economically than other drains due to their longer life.

Toncan Iron drains are flexible and unaffected by pounding wheels and the pressures from shifting soil.

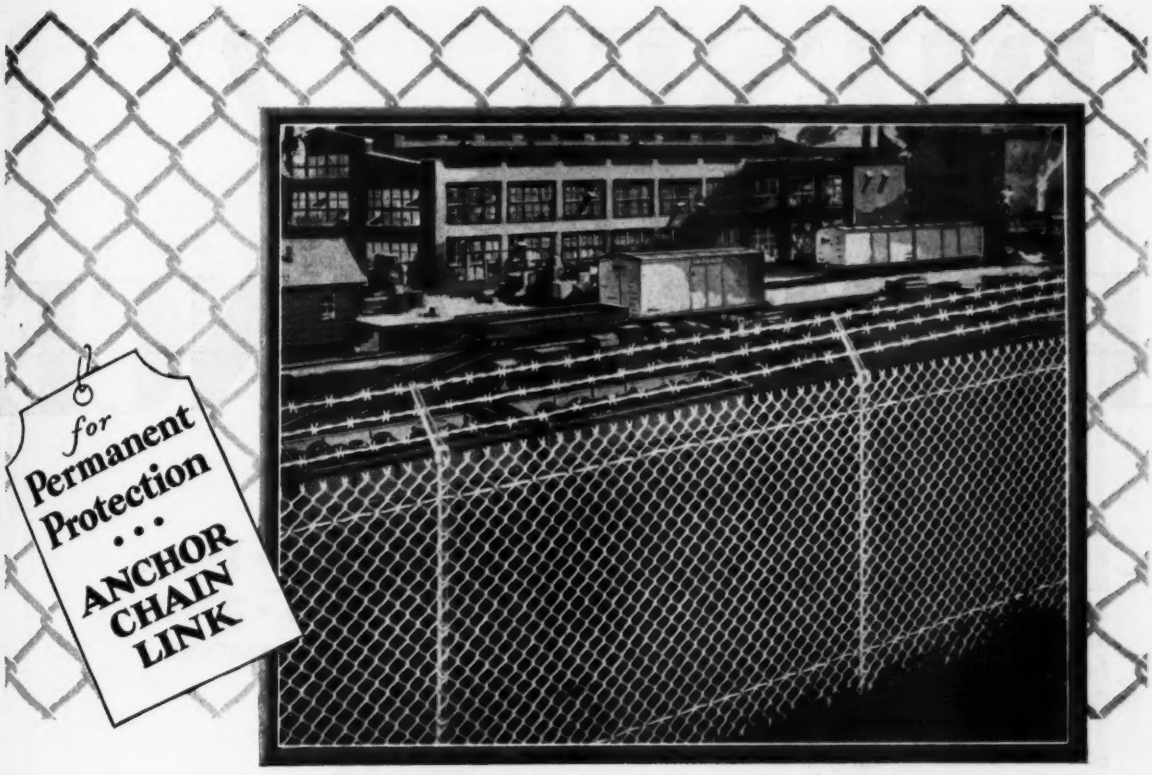
They are also more durable than other metallic drains due to their Toncan Iron composition.

Toncan Iron drains have an added resistance to corrosion and erosion gained through the protective presence of copper and molybdenum. These elements give the naturally resistant iron still further protection against rust and corrosion.

TONCAN CULVERT MANUFACTURERS' ASSOCIATION, MASSILLON, OHIO

The Canton Culvert & Silo Co. Canton, Ohio
The Berger Mfg. Co., of Mass. Boston, Mass.
The Berger Manufacturing Co. Philadelphia, Pa.
The Berger Manufacturing Co. Roanoke, Virginia
The Berger Manufacturing Co. Jacksonville, Florida
The Berger Manufacturing Co. Dallas, Texas
The Berger Manufacturing Co. Minneapolis, Minn.
The Berger Manufacturing Co. (Export), Canton, Ohio
Tri-State Culvert Mfg. Co. Memphis, Tenn.
Tri-State Culvert Mfg. Co. Atlanta, Ga.
The Firman L. Carswell Mfg. Co. Kansas City, Kan.
Wheat Culvert Co., Inc. Newport, Ky.
Beall Pipe & Tank Corp. Portland, Ore.
Superior Culvert & Flume Mfg. Co. Los Angeles, Calif.
Superior Culvert & Flume Mfg. Co. Oakland, Calif.
The Thompson Mfg. Co. Denver, Col.
The Pedlar People Limited, Oshawa, Ontario, Canada

TONCAN COPPER MO-LYB-DEN-UM IRON



Longer life . . . Less maintenance

. . the result of four exclusive Anchor Fence features

FOR each vital point in a fence an exclusive Anchor feature has been developed to defeat wear, tear and strain. Each of these features has demonstrated its value under severe service—proved that it lengthens fence life and reduces maintenance to a negligible amount.

The careful fence buyer will quickly recognize the advantages that must result from such improvements as: a gate frame of heavy *square* tubular steel, *arc-welded* at corners; *square* tubular steel terminal posts; U-shaped intermediate posts; Drive-anchorage which supports posts firmly in any soil, gripping the soil like the roots of a tree. *All Anchor Posts are made of high carbon steel*—not mild steel. And the fabric used for Anchor Chain Link Fences is made of copper-bearing steel wire, heavily galvanized *after* weaving.

Have the nearest Anchor office send information about these improvements found in every Anchor Chain Link Fence.

Anchor Post Fence Co., Eastern Ave. & Kane St., Baltimore, Md.

Albany; Boston; Charlotte; Chicago; Cincinnati; Cleveland; Detroit; Hartford; Houston; Los Angeles; Mineola, L. I.; Newark; New York; Philadelphia; Pittsburgh; St. Louis; San Francisco; Shreveport

Representatives in all principal cities. Consult local classified directory.

ANCHOR Fences

MADE BY THE MAKERS OF AMERICA'S FIRST CHAIN LINK FENCE

DIESEL LOWER COST PERFORMANCE!

P & H Diesel Excavators are taken care of as easily as a gas machine. Because of their *increasing* torque in tough going, the daily yardage is 10%-15% greater. They consume but ½ as much fuel by volume—fuel that is considerably cheaper than gas.

The result is more yardage per day at less cost, far greater profit per job. Your gas-power operators can quickly learn to operate the P & H Diesel Excavators. Let us tell you *all* about these powerful machines.

1 YD. - 1¼ YD.
2 YD. - 3½ YD.
CAPACITIES

P & H Model 700 1¼-yard Dragline on levee construction near Osceola, Arkansas.

HARNISCHFEGER CORPORATION
Established in 1884
3820 National Avenue, Milwaukee, Wisconsin
Offices and Agents in All Principal Cities

P&H

DIESEL EXCAVATORS

GREATER YARDAGE AT LOWER COST

9100

Safe . . . when it's Red-Leaded

SAFE from rust . . . from destruction! And steelwork protected by pure red-lead paint requires a minimum of maintenance work. This paint provides sure protection against corrosion . . . safeguards the strength and life of steel structures . . . lasts for a remarkably long time.

Engineers and others who have studied paint for metal know that three coats of pure red-lead give lasting protection . . . provide a film unexcelled in rust-proofing qualities.

Fine, uniform, highly oxidized, there is no better red-lead obtainable than Dutch Boy red-lead. It comes in two forms . . . paste and liquid. The liquid (ready for the brush) is supplied in six colors—natural orange-red, light and dark brown, light and dark green, and black. The paste comes in natural orange-red and can be shaded to dark colors.

NATIONAL LEAD COMPANY

New York, 111 Broadway • Buffalo, 116 Oak Street
Chicago, 900 West 18th Street • Cincinnati, 659 Freeman Ave. • Cleveland, 820 West Superior Ave. • St. Louis, 722 Chestnut St. • San Francisco, 235 Montgomery St.
Boston, National-Boston Lead Co., 800 Albany St. • Pittsburgh, National Lead & Oil Co. of Pa., 316 Fourth Ave.
Philadelphia, John T. Lewis & Bros. Co., Widener Bldg.

DUTCH BOY RED-LEAD

CARNEGIE

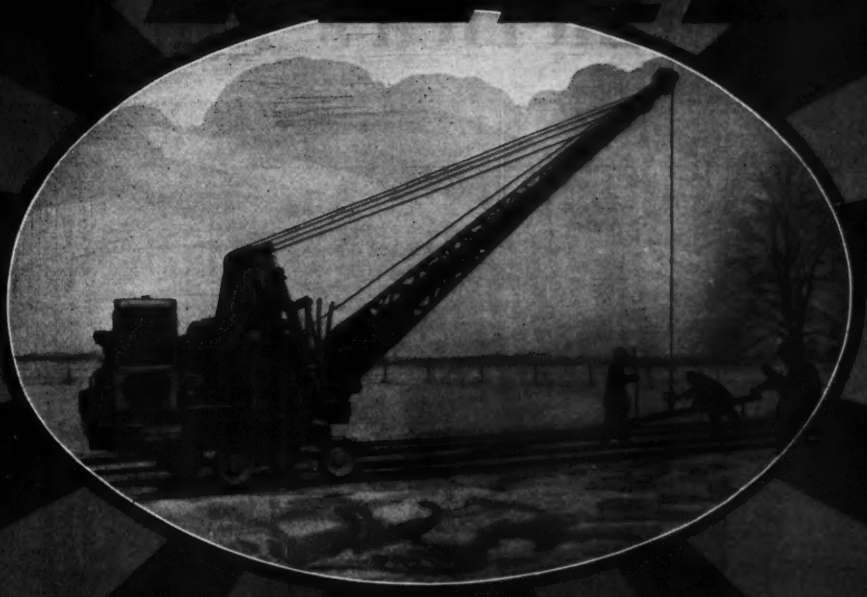
RAILS

& RAIL JOINTS

Control of manufacture from ore mine to finished product, plus unlimited facilities for correct manufacture, permit us to serve you promptly and efficiently. Let us quote on your next requirements.

CARNEGIE STEEL COMPANY

PITTSBURGH, PA.



Inbuilt working ability saves Time, Labor and Money

When time means money and every delay boosts your handling costs, then real ACTION counts most. That's just when a speedy Buckeye Utility Crane on the job sets the pace that gets you out from under. It may be any service, from moving miscellaneous material to laying rail. Within its capacity, all are in a day's work for this *Buckeye*. Well-planned operation can always find a job ready and one waiting for it—*"Every Day It Pays Its Way."* Standard flanged wheel equipment permits the Buckeye to operate either from the track or from rails laid on a flat-car. Alligator (crawler) traction is available for service independent of track.

The Buckeye has everything usually associated with high-grade Cranes of its class, excepting only weight and price. Standard equipment includes Timken roller bearings; two speeds for all operations, providing unusually flexible working ability; one-man control; full-circle operation; and adjustable length boom.

Let us tell you more about this fact, time-saving Buckeye Utility Crane. Interesting literature sent on request—write today.

THE BUCKEYE TRACTION DITCHER COMPANY
Findlay, Ohio

There's a Buckeye Sales and Service Office Near You

Buckeye

for 127 Years
it held America's finest rum

IT was fine rum that came out of New England in the early days. And the finest of it all—state those ancient Down-Easters who can't recall it without a slight gulp and a tear—came from the distillery founded in 1790 by Messrs. A. and G. J. Caldwell at Newburyport, Massachusetts.

Through five generations of the Caldwell family, nothing but the finest of materials would serve for the distillation and aging of their proud product.

And so the Caldwells selected Tidewater Red Cypress for their storage tanks. This southland lumber was chemically inert and was the most durable lumber that America produced.

Then 1917 brought the ban of Mr. Volstead. The distillery met its first and final defeat. But the Tidewater Red Cypress is still sound as a dollar.

Railroads find Tidewater Red Cypress especially suitable for passenger station construction, freight sheds, warehouses, ties, platforms, signal conduits, water tanks, box cars, fencing, and, in short, any use where long life and freedom from repairs are essential.

Technical data will be supplied gladly by the Southern Cypress Manufacturers' Association, Jacksonville, Florida.

Specify **TIDEWATER RED CYPRESS**

THE WOOD ETERNAL

Safer Bonds

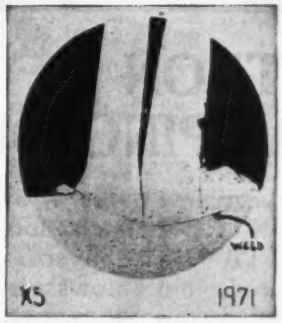
American Signal Bonds

The Type DS-1 Bond is made with the usual steel pin and two conductors, each conductor composed of one central copper wire surrounded by six galvanized steel wires.

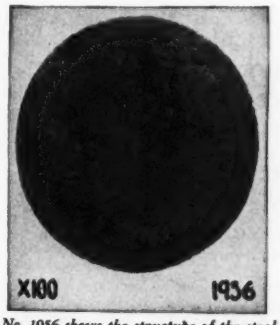
A TEST

In order to disprove that the wires in our American Stranded Signal Bonds are adversely affected by the welding heat, we had this examination made. The extreme heat localization which is effected by our process is clearly illustrated in the following micro-photographs. Photograph No. 1971 shows the weld under low magnification. Photograph No. 1956 shows the structure of the steel adjacent to the weld along the wires. Photograph No. 1965 shows the normal structure of the wires which is found at .2 cm. from the weld. It is very interesting to note that the grain structure of the wires is refined immediately adjacent to the welds, instead of coarsened, as would be the case if the wires were overheated. This refinement is obtained by performing work upon the wire while hot. Consequently, we obtain a refinement of the metal adjacent to the welds and maintain the normal structure to within .2 cm. from the welds.

The Type S-1 Bond is made with the usual steel terminal and one conductor composed of one central copper wire surrounded by six galvanized steel wires.

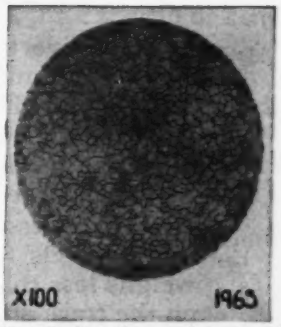


No. 1971 shows the weld under low magnification.



No. 1956 shows the structure of the steel adjacent to the weld along the wires.

The American Steel & Wire Company has a rail bond for every requirement. Our engineers will be glad to assist you in selecting the best bond for your needs.



No. 1965 shows the normal structure of the wires which is found at .2 cm. from the weld.

American Steel & Wire Company

Subsidiary of United States Steel Corporation

208 S. La Salle Street, Chicago 30 Church Street, New York

Other Sales Offices: Boston Cleveland Worcester Philadelphia Pittsburgh Buffalo Detroit Cincinnati Baltimore Wilkes-Barre St. Louis Kansas City Minneapolis-St. Paul Oklahoma City Birmingham Atlanta Memphis Dallas Denver Salt Lake City U. S. Steel Products Company: San Francisco, Los Angeles, Portland, Seattle *Export Distributors:* United States Steel Products Co., 30 Church St., New York

A *Matter of* MINUTES *—not hours!*

—to move a SYNTRON TIE-TAMPING OUTFIT

Four or five men, in a very few minutes, can move the SYNTRON TIE-TAMPING OUTFIT. No special cribbing is required. No track tie-up. No delays. For the SYNTRON Power Unit is only twenty inches wide, equipped with dolly wheels for riding on a rail, weighs less than 750 lbs. and rests on the track shoulder.

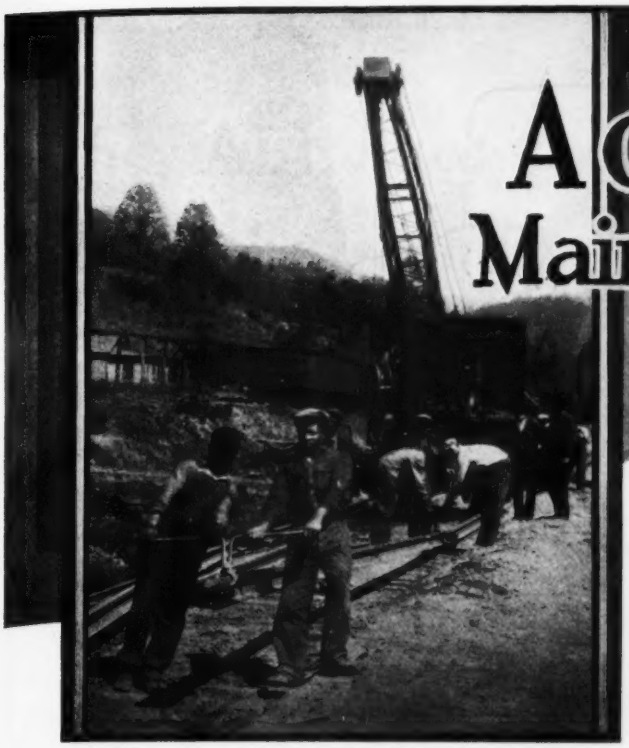
A SYNTRON Power Unit operates 4, 6 or 8 electrical tampers, each doing the work of 4 men, delivering 1500 speedy, powerful blows a minute.

For economy of time and expense, investigate the SYNTRON. Write for free descriptive literature. Address

SYNTRON COMPANY
400 Lexington Ave., PITTSBURGH, PA.

SYNTRON

Electric TIE-TAMPING OUTFIT



A Complete Maintenance of Way Crane

Relaying steel on the Louisville & Nashville Railroad with an ORTON Model "MW" Maintenance of Way Crane equipped with a 40-foot boom, fall block and hook.

Designed especially for track laying and for handling track materials, the new Model "MW" crane represents the most modern type of machine for this class of work.

Built as carefully as the larger ORTON models, the "MW" is a *real* locomotive crane that will do the work of the maintenance of way department speedily and efficiently. It is fully developed and completely equipped, and the sturdy construction insures long and dependable performance with a minimum of upkeep. Initial cost is only a fraction of that of the larger cranes.

Users like the C., M., St. P. & P., the Southern, and the L. & N. find that an "MW" crane will keep a crew of 100 to 150 men busy laying rails.

The "MW" also is used for general utility work, such as placing switches and signal towers, setting bridge timbers, and for all kinds of lifting too heavy for men and not heavy enough to justify the expense of sending out a crew with a large locomotive crane. A ½-yard clamshell bucket can be used for cleaning ballast or handling loose materials, or a 36-inch magnet for handling steel parts and scrap. Provision also can be made for equipment with a generating set or an air compressor for operating track tools.

Ask for specifications and detailed information on this complete maintenance of way crane.

Full-Revolving
Travels 20 Miles an Hour
Lifts 17,000 Lbs.

Eight traveling speeds, ranging from 1½ to 20 miles an hour.

Lifting capacity, 17,000 lbs. at a 10-foot radius.

Drawbar pull, 9000 lbs.; in low speed will pull 8 to 10 loaded cars.

Furnished with electric-welded, lattice-type boom of ample length to unload rails directly from gondola cars.

A 55-hp. heavy-duty gasoline engine provides plenty of power and affords one-man operation.

Fully enclosed all-steel cab, with operator's position clear out in front where he can see on both sides.

Short tail swing so that rear end does not foul passing track.

Electric-welded carbody, with axles carried by spring-backed journals.

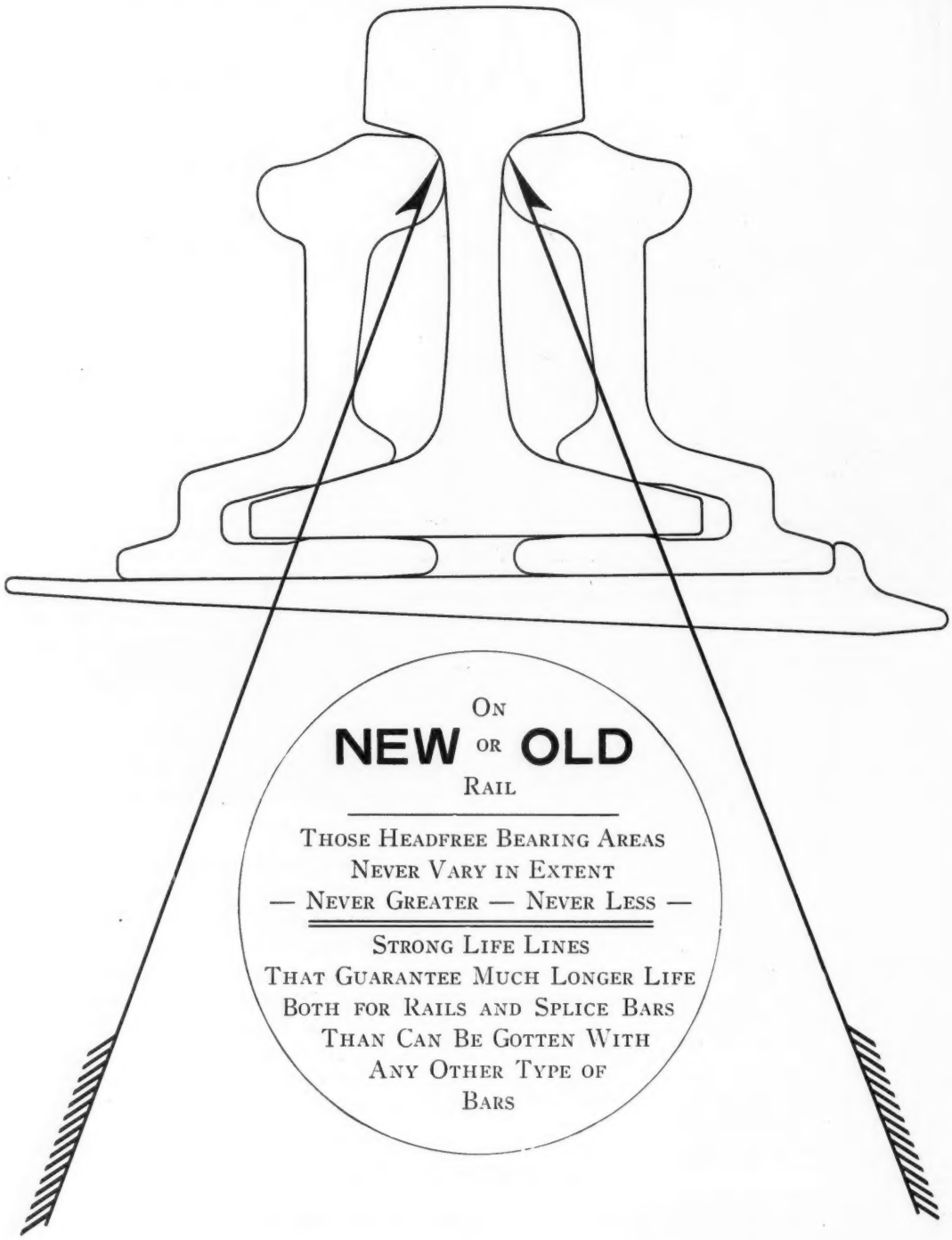
Powerful "V" type clutches, and a separate clutch for each operation.

ORTON CRANE & SHOVEL CO.
608 S. Dearborn St., Chicago, Ill.

Manufacturers of Locomotive Cranes; Flexible Tread Cranes, Shovels, Draglines, Ditchers and Skimmers; Truck Cranes; Road Wheel Cranes; Gantry Cranes; Clamshell and Orange-Peel Buckets; Coal Crushers

Representatives in Principal Cities

ORTON
Cranes, Shovels & Buckets



ON
NEW OR OLD
RAIL

THOSE HEADFREE BEARING AREAS
NEVER VARY IN EXTENT
— NEVER GREATER — NEVER LESS —

STRONG LIFE LINES
THAT GUARANTEE MUCH LONGER LIFE
BOTH FOR RAILS AND SPLICE BARS
THAN CAN BE GOTTEN WITH
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BARS

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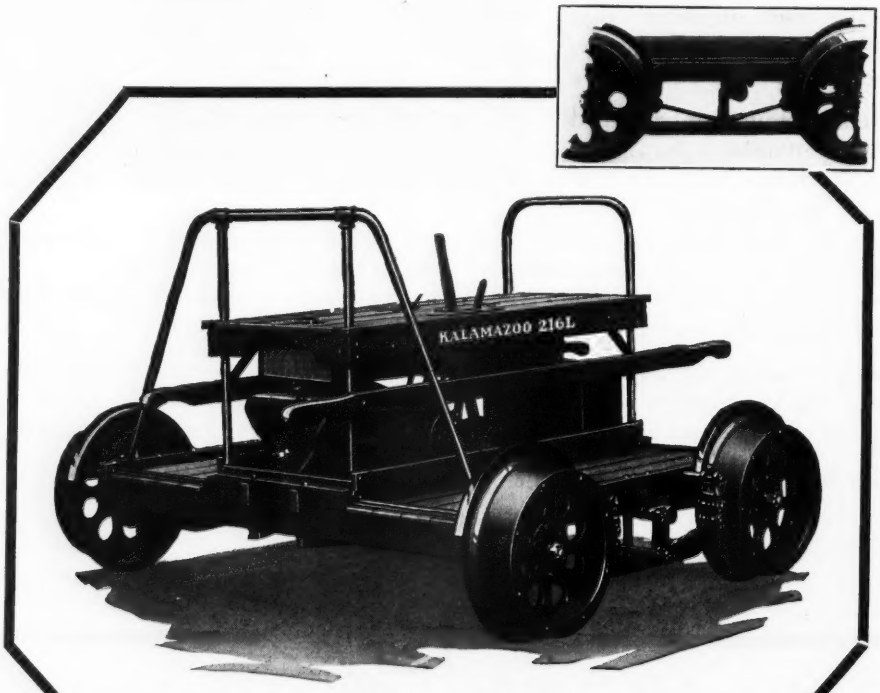

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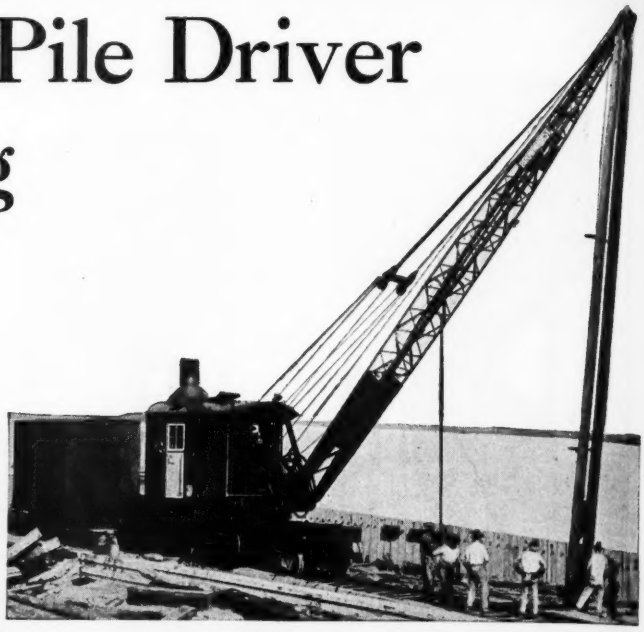

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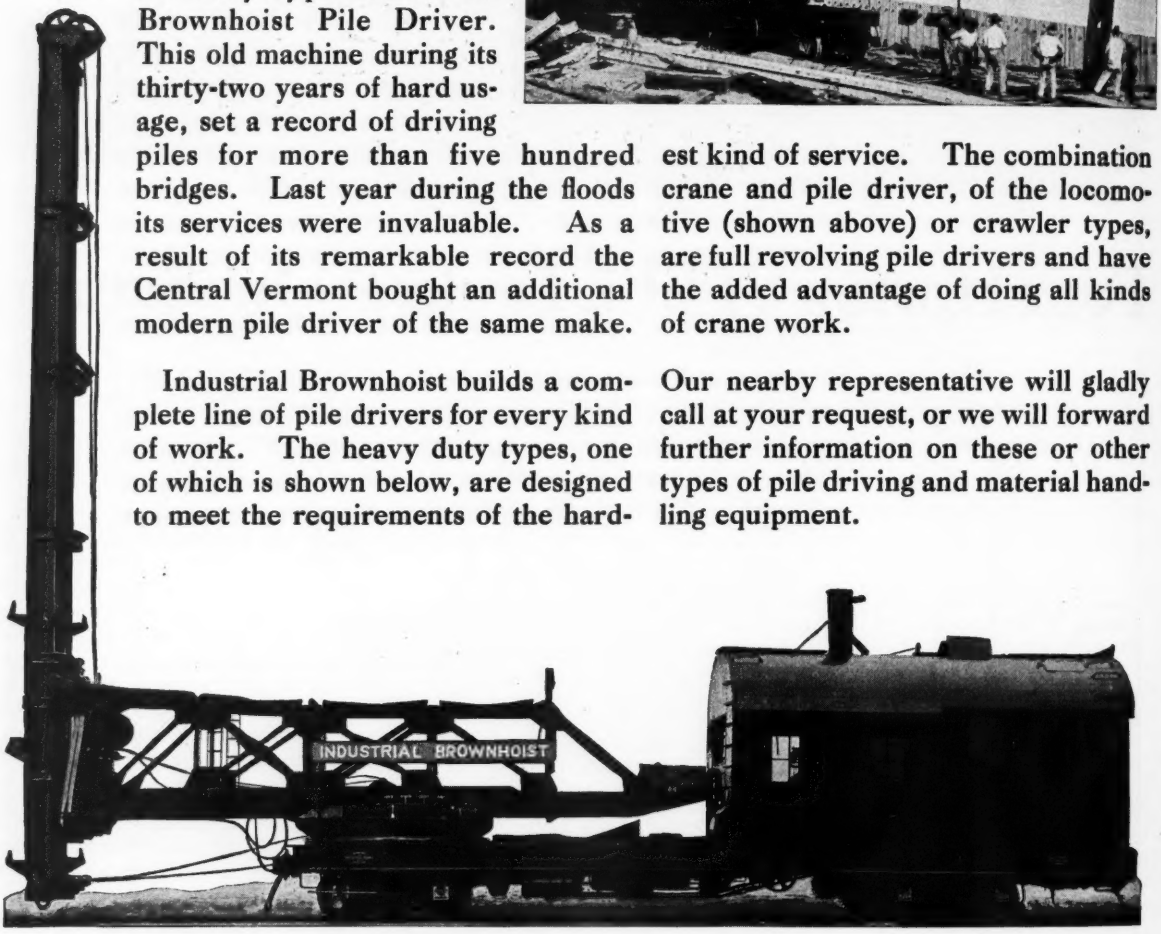

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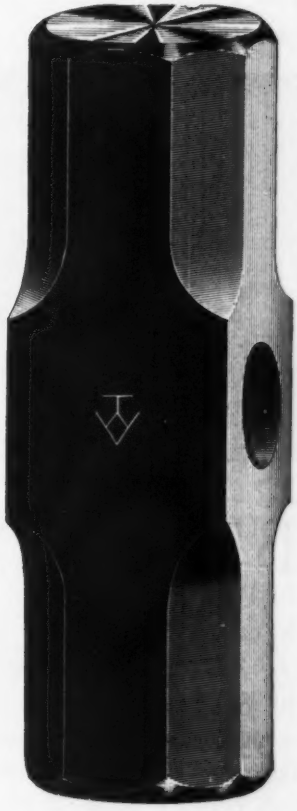
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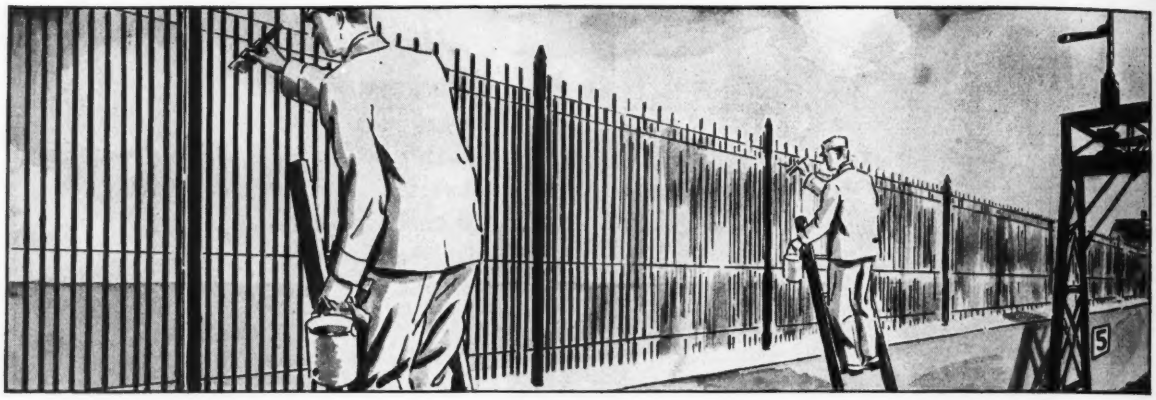

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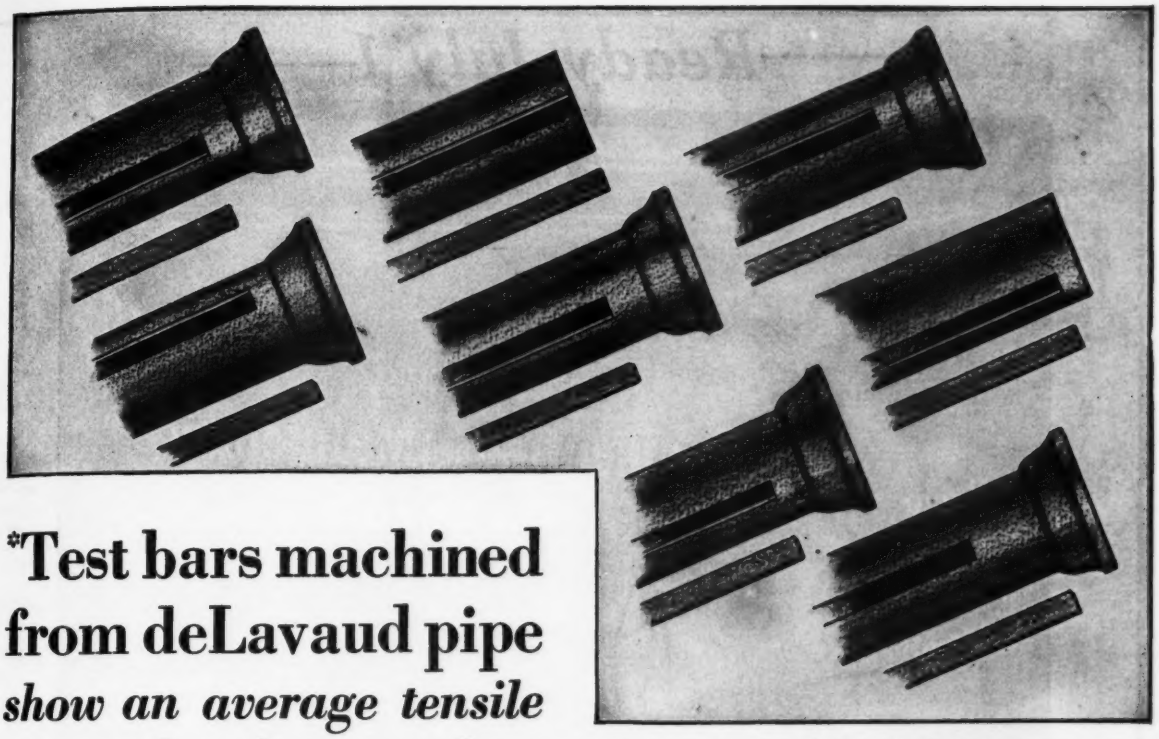

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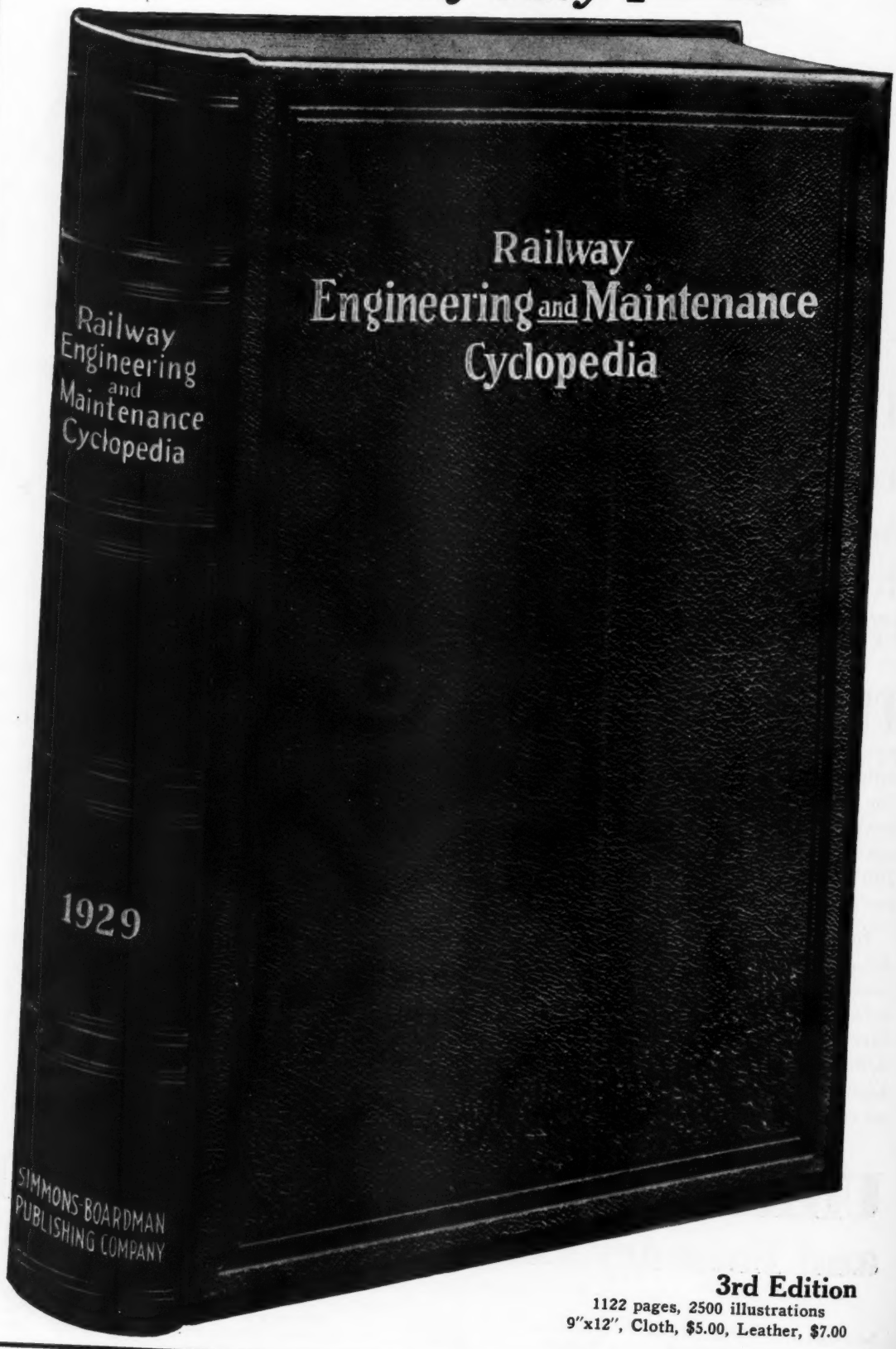

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May 30, 1929

Dear Reader:
Everywhere

In the April issue I wrote you of our editorial staff and its background of railway experience. I now want to tell you of our second line of editorial support - our contributors. I am proud of this group of practical railway men - more than 120 of them in 1928 - who, because of their interest in the promotion of efficient railway practices, contribute of their experience in order that other railway men confronted with similar railway problems may profit thereby.

I realize that the preparation of a description of an idea or of a method takes time that is not readily spared. I also appreciate the fact that the writing of an article, even though brief, or even the collection and forwarding of information to us from which we can prepare an article for publication, is no simple task for one who does this only occasionally and for whom writing does not come easily. Yet it is only through such cooperation that many noteworthy accomplishments are made matters of permanent record. For these reasons we and the railways to whose efficient maintenance our publication is dedicated are doubly indebted to our contributors.

Our contributors include men in all ranks of service, chief engineers, engineers maintenance of way, bridge engineers, architects, engineers of water service, roadmasters, master carpenters, foremen - each writing from his specialized experience. No men are better qualified to discuss problems of roadway construction than C. A. Morse, George J. Ray or Earl Stimson. There are no closer students of maintenance of way economics than John V. Neubert, G. A. Phillips, W. J. Backes or Bernard Blum. None excels C. R. Knowles or W. S. McCaleb as authorities on water supply problems. The standing of G. A. Haggander, Glen H. Trout and I. L. Simmons in bridge engineering and of such men as A. T. Hawk and W. T. Krausch in the problems of railway building design and maintenance is recognized, while in the more specialized lines of timber preservation, Dr. Herman von Schrenk and R. S. Belcher stand at the top.

Of such men and many others of similar standing is the contributing staff of our publication composed. It is a common saying among publishers that a paper is known by the number and character of its contributors. We are proud to be measured by this standard.

Yours sincerely,

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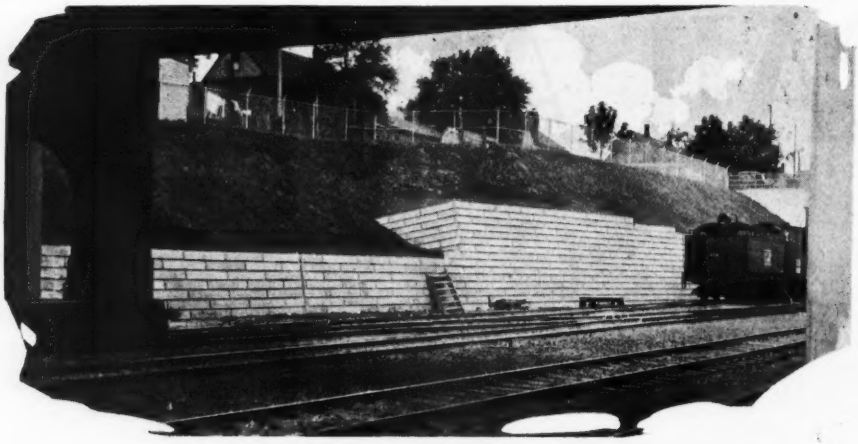

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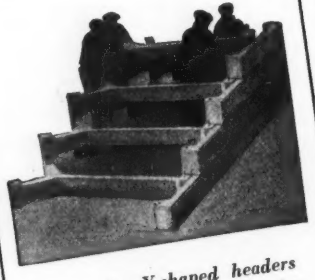

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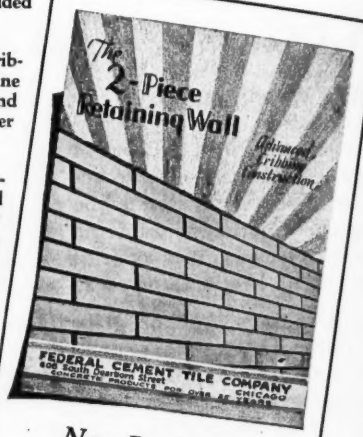

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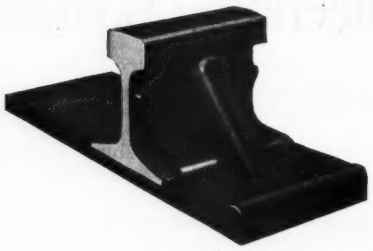

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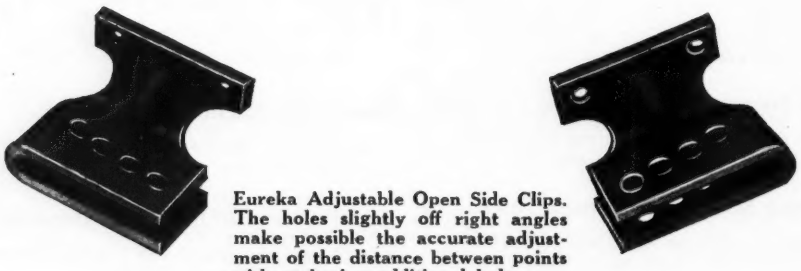

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Railway
Engineering and Maintenance

Volume 25 June, 1929 No. 6

Avoid Damage to Rails

A FEW DAYS ago a new rail was discovered with the web so badly cracked as to require immediate replacement, and this, within a few hours after it had been laid in track. An examination of the fracture showed the marks of a maul on the web at the point of rupture, showing that the failure was due to the rail having been struck in the application of a rail anchor. While such extreme results are unusual, blows such as that which gave rise to this failure are more common than are generally realized. They, therefore, constitute a form of carelessness which is to be guarded against, particularly at this season of the year when so much rail is being relaid.

In these days when modern traffic demands so much of a rail and when there are so many apparently unavoidable deficiencies in them, it is essential to safety of travel that rails be subjected to no unnecessary abuse. Because of the danger of damaging rails and the even more serious consequences that may follow therefrom, it is important that track foremen and supervisory officers see that the men in their gangs realize the possible consequence of a careless blow and exercise the necessary care to avoid their occurrence.

Possibilities of Work Equipment

SOME FIVE or six years ago the chief sales executive of a company making a well-known unit of work equipment came to the conclusion that the railways no longer offered a promising market for this equipment because of the practical saturation of the market. His product was standard on most roads and they were, in general, equipped as fully as the then-developed uses warranted. Practically the only business in sight, therefore, was that of replacement of existing equipment as it wore out. In contrast with this conclusion, this company is now unable to accept orders for delivery within six months, in spite of the fact that its productive capacity has been materially increased since that time.

What has brought about this change? Is it due to error in the earlier diagnosis? On the contrary, it is due, rather, to the development of new applications for this equipment—applications which were unthought of a few years ago, but which have so greatly widened its possibilities as to create the feeling now that the surface has only been scratched. This has come about because of the fact that those responsible for this machine's future faced the necessity for new markets—and they met this by studying the possibilities of this equipment as they had never studied them before. When they did this they found one new application after another presenting itself until today it is in reality a many-purpose unit.

This incident is not unique in the annals of railway work equipment. It can be duplicated frequently, yet it illustrates a condition that still prevails among many builders of such equipment. The future of work equipment for maintenance work depends as much on the broadening of the applications for devices now available as on the design of new equipment. It rests on the ingenuity of railway and railway supply men alike.

A New Era in Timber Utilization

A FEW weeks ago a prominent railway framed a large timber trestle complete, including the sway bracing, at its wood-preserving plant prior to treatment, with such success that it was necessary to bore only one new hole in the field. About the same time another road framed a standard wooden water tank at its timber-preservation plant so completely that the tank was erected without the mutilation of a single stick. These instances are cited not because of their novelty, for operations such as these are becoming quite common, but rather to refute the attitude of numerous railway men that such methods are not practical.

Railway maintenance work is undergoing rapid change today. Not the least important of these changes is a new attitude toward timber and its use. The carpenter with his saw and adz is a heritage of the day when timber was plentiful and inexpensive. With the increasing cost of timber in recent years and particularly with the demonstration of the economy of its treatment to double and treble its life, new methods are required. We are rapidly approaching the day when the use of timber untreated in other than the most temporary structures will be condemned as wasteful. We are already beginning to realize that the cutting or framing of timber after treatment is still more wasteful. This points to the necessity of the more accurate determination of the dimensions of each stick in order that it can be framed to exact size before treatment and thereby present an unbroken protection against the agencies of decay when inserted in the structure.

It is here that differences of opinion arise. Many of those who have become accustomed to carpenter methods do not see how it is possible to frame timber with any degree of accuracy in advance of installation. Yet these same men accept without question the necessity of fabricating to the smallest detail, every member that enters into a steel structure, no matter how small this member may be. Furthermore, evidences of the entire practicability of fram-

ing timber accurately in advance, such as cited above, are constantly accumulating, while such roads as the Baltimore & Ohio and the Midland Valley have found it practical to frame all such timbers at a central point in advance of treatment on a system-wide basis.

The day is rapily approaching when our structural timber requirements will be determined as accurately as is now our practice with steel. Those roads which avail themselves of the experience now at hand will profit first and most largely.

Restraining the Motor Car "Speed Maniac"

THE VALUE of the motor car in maintenance of way work is so well established that to present arguments in its behalf is only to rehash what has been said before, and well said, but, like many other modern aids to industry, its use must be exercised with good judgment. Undoubtedly most of the injuries to employees resulting from motor-car accidents are caused directly or indirectly by violations of the rules covering the speeds at which such cars are to be operated. The word indirectly is used advisedly, for, while unavoidable accidents will occur with motor cars, just as they happen with the more sedate hand car, the resulting injuries are contingent upon the speed of the car at the time of the accident; a derailment at the permitted speed may cause no personal injuries, while a derailment at the same spot at high speed may have serious results.

These facts are admitted and appreciated by all who have anything to do with the operation of motor cars, even including those who disregard the rules when they feel safe from detection. Since there are few opportunities for checking up on the speed of cars in the absence of the supervisory forces, the roadmaster or supervisor is confronted with a situation which is not controlled easily and which must be handled diplomatically if the best results are to be obtained in the campaign for safety. It has been suggested that the cars be geared or governed so that the allowable speeds cannot be exceeded, but this is not satisfactory in all cases. In the main, reliance must be placed on the education of, and co-operation with, the men, supplemented by rigid discipline, and in this the supervisory officer must be careful to set a good example at all times, for there is no surer way to invite contempt for any rule than its violation by those who have the authority and duty to enforce it.

A Ten-Hour Day

MAINTENANCE of way officers have long recognized the advantages that accrue from the building up of a permanent all-year-round force of experienced employees. It is this knowledge that has caused them to transfer numerous operations, such as the relaying of rail, to the winter season in order to provide constructive employment for men who would otherwise be laid off and thereby, to a considerable degree, lost to the railway the following season.

However, there is another expedient available for maintenance officers which is little utilized, but which aids in the same direction. This is the more general utilization of the ten-hour working day during the active summer season. This was the standard day for maintenance work prior to the period of federal control and it was not unusual for gangs to work 11 hours. In the agreements drafted while the government was operating the roads, the eight-hour day was established, although without penalty overtime rates for the ninth and tenth hours. As a result, nearly all railroads now adhere to an eight-hour day for their maintenance forces, recruiting enough additional temporary labor each spring to enable them to complete the work in hand. This added labor force has reached the high total of 150,000 men in recent normal years, a vast army of men who must be turned loose in the fall.

A ten-hour day for these forces during the summer months will go far to correct this condition. The addition of two hours working time should result in an increase of 25 per cent in output and reduce the number of men required by that amount. Actually, however, it does more than that, for the average gang spends at least an hour in going to and from work and in getting started and closing down, regardless of the length of working day. The increase in actual working time is therefore, nearly 30 per cent. Furthermore, every increase in the ratio of experienced to inexperienced employees is reflected in added output so that the production of a gang is increased by more than a third by the addition of two hours to its working period.

From the standpoint of the men, an increase in the working day to 10 hours is regarded as equivalent to a raise in pay, for while their compensation is fixed at a definite rate per hour, they regard it as the amount they earn per day and very generally welcome the ten-hour day as a means of increasing their income 25 per cent. With such mutual advantages, it is surprising that the ten-hour day does not again become universal in maintenance of way work. Such a move would reduce by half the extra force now "hired each spring and fired each fall."

Modern Facilities Make Better Foundations Possible

NO PHASE of the work of the bridge man gives rise to greater opportunity for error or calls for the exercise of finer judgment based on seasoned experience than that relating to the foundations of bridges. There are no definite rules that may be applied. Sound judgment must control. It comes into play first in determining how much information must be had before a reasonable decision can be made, but is of greatest importance in reaching a decision on the information obtained.

However, the bridge builder of today, whether he is developing plans for a new bridge or studying contemplated repairs of an old one, has marked advantages over his predecessors of years gone by. He has better materials and equipment at his disposal and, as a rule, he is permitted to spend more money to obtain secure foundations for his bridge.

Every officer of bridge maintenance is familiar with the old type of pier foundation in which the pier shaft, usually of stone masonry, rests on a timber grillage which is in turn supported on piles cut off just low enough to insure that the timber work is normally submerged. He may also have had experience with pier footings carried to rock or other stable foundation but which had been built by placing concrete under water. The timber grillage is a thing

of the past and the placing of concrete under water is now done only as a last resort, when other methods have proved impractical or unduly expensive, but both were formerly common expedients.

The advent of the steel sheet pile, the large capacity centrifugal pump and the modern excavating bucket manipulated by modern hoisting equipment has had much to do with the raising of the standards of foundation practice, because with their use it is practicable to unwater open foundations under much greater hydrostatic heads than formerly. Thus we now find bridge maintenance forces enclosing an old pier footing with a cofferdam, pumping out the water and excavating around the piles beneath the old footing to a depth such that men can walk around among the supporting piles, although the original builders had established the cutoff elevation at what they thought was the maximum practical depth.

The advent of reinforced concrete also opened new fields and has made it possible to do at reasonable expense what formerly would have entailed a prohibitive outlay. It is therefore reasonable to say that the type of foundation and the construction methods employed in building the substructure of the Michigan Central bridge over Deep river, described on page 240 of the issue, were possible only because of the knowledge and equipment available today. Picture the difficulties which would have attended efforts to build the piers of the type designed for this bridge of stone masonry and old rails or I-beams, with the aid of a drop hammer in the leads of a skid driver and the making of all excavation by hand.

Obsolescence in Work Equipment

ONE WHO compares the methods of the railways and the electrical industry cannot fail to note the marked contrast in their attitude towards obsolete equipment. The railways, on the one hand, are prone to continue to use equipment as long as it will operate, while with the leading power companies, central station equipment is constantly giving way to newer and more efficient units long before it is worn out. In the engineering and maintenance of way departments this has not been a serious problem until lately because the amount of equipment employed has been limited. Within the last few years, however, large sums have been spent for a wide variety of equipment. Furthermore, the development in this equipment is more rapid than ever before, with the result that it is being made obsolete by the rapid introduction of newer substitutes. The problem of obsolescence is therefore coming before maintenance officers rapidly and is changing their attitude towards work equipment from that of determining if it will still operate to that of ascertaining whether one can afford to continue its use in the light of the more modern facilities now available.

That this problem is already being recognized by some roads is shown by the replacement orders now being placed, as illustrated by the replacement by one leading road of more than 140 old section motor cars this spring by the same number of newer and more modern cars. Other roads are retiring steam shovels, spreaders and, more recently, such equipment as the earlier designs of tie tampers, etc. However, this movement is still in its infancy and on many roads is not yet evident.

With the rapidly growing use of work equipment of many types, engineering and maintenance officers are facing a new problem of determining when economical considerations demand the retirement of this quipment. It is a problem that requires the most careful study, but it is also one which offers large possibilities for economies in the conduct of work.

A Machine Age

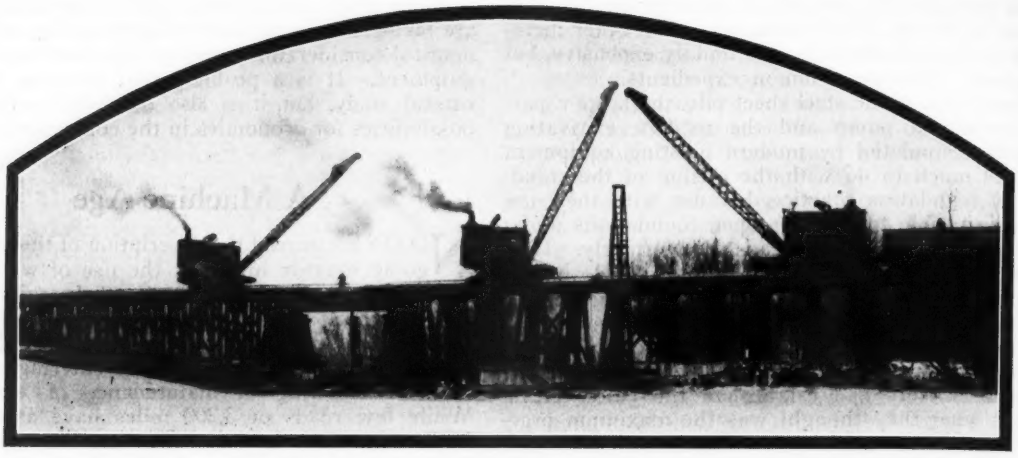
NO ONE can read the description of the thoroughgoing manner in which the use of work equipment is supervised on the Central region of the Pennsylvania, as portrayed by J. B. Baker, engineer maintenance of way of that region on page 255, without realizing that we are rapidly entering an era of machine handling of maintenance of way work. While few roads of 3,200 miles have as many as 1,500 units of mechanical equipment in service, many are approaching this degree of utilization more rapidly than they appreciate. This transition from manual to mechanical methods is making necessary the revision of working methods to an extent that is as yet only partially realized.

Not many months ago the officer in charge of work equipment on a large road was told by his superior officers that he could secure a half million dollars' worth of work equipment this year if he would include it in his budget. To their surprise, he replied that the road was not yet organized to use or maintain efficiently more than half this amount of new equipment in addition to that already on hand. The budget was therefore confined to the smaller quantity.

It is axiomatic that a road is not warranted in purchasing any equipment unless its economy can be demonstrated. It is one thing, however, for a machine to be *able* to show economy and another quite different thing for it to be so used in day-to-day work as to effect this saving. Although a unit of equipment may have demonstrated marked economies on one road, its purchase by another road may be entirely unwarranted because shortcomings of administration will make it impossible for the second road to obtain the desired results.

In many cases the most efficient use of equipment involves the reorganization of working methods. In this respect, only a beginning has yet been made. Again, attention must be given to the correlation of the activities of different gangs to secure the most constant and intensive service from the equipment. This detailed supervision is also required to insure that delays in the use of such equipment is detected and the cause removed most quickly. All too frequently, this is left to local supervisory officers who, burdened with many other responsibilities that are of more direct personal interest to them, fail to function.

Again, many roads which operate their equipment with reasonable efficiency, fail with respect to its maintenance. This is due most commonly to failure to appreciate the present shortcomings of methods that were devised when this equipment was far less numerous. As a result, it is turned over to men who are neither interested in nor familiar with its operation and the results are perfunctory. All of which demonstrates that the use of work equipment has now grown to the point where each road can afford to approach the subject anew to determine how this equipment can be employed most efficiently and then proceed to put these conclusions into effect.



Three Locomotive Cranes Formed an Important Feature of the Construction Equipment

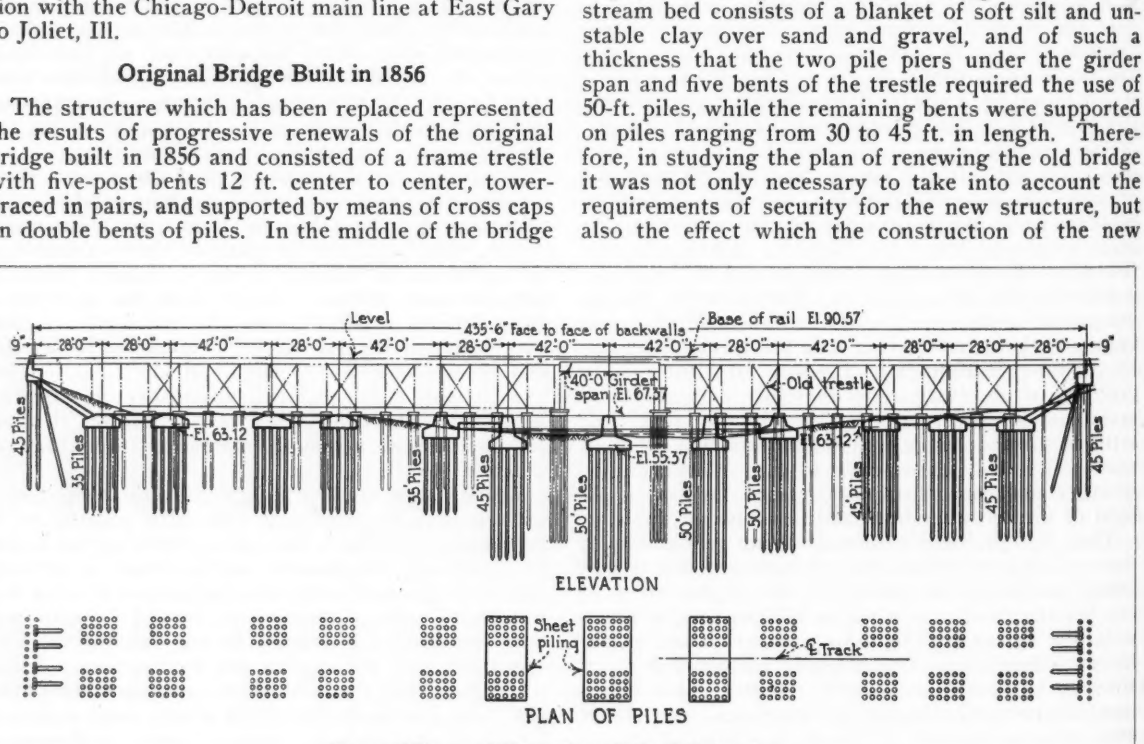
Soft Bottom Calls for Special Design in Bridge Renewal

THE selection of the steel-tower viaduct type of construction for a 435-ft. bridge having top of rail only 30 ft. above the bed of stream was the unusual expedient adopted by the Michigan Central in the renewal of an old frame trestle. Exceptionally unfavorable foundation conditions were primarily responsible for the adoption of this design and also gave rise to the employment of rather exceptional details of the substructure.

The bridge is located near East Gary, Ind., on the single-track freight line which extends from the junction with the Chicago-Detroit main line at East Gary to Joliet, Ill.

Original Bridge Built in 1856

The structure which has been replaced represented the results of progressive renewals of the original bridge built in 1856 and consisted of a frame trestle with five-post bents 12 ft. center to center, tower-braced in pairs, and supported by means of cross caps on double bents of piles. In the middle of the bridge a channel opening was provided by a 40-ft. deck girder span supported on double frame bents resting on pile piers. While the stream, known by the misfit name of Deep river, is a shallow, sluggish one, subject to but little variation in water stage, it has imposed serious problems on the bridge builder. The stream bed consists of a blanket of soft silt and unstable clay over sand and gravel, and of such a thickness that the two pile piers under the girder span and five bents of the trestle required the use of 50-ft. piles, while the remaining bents were supported on piles ranging from 30 to 45 ft. in length. Therefore, in studying the plan of renewing the old bridge it was not only necessary to take into account the requirements of security for the new structure, but also the effect which the construction of the new

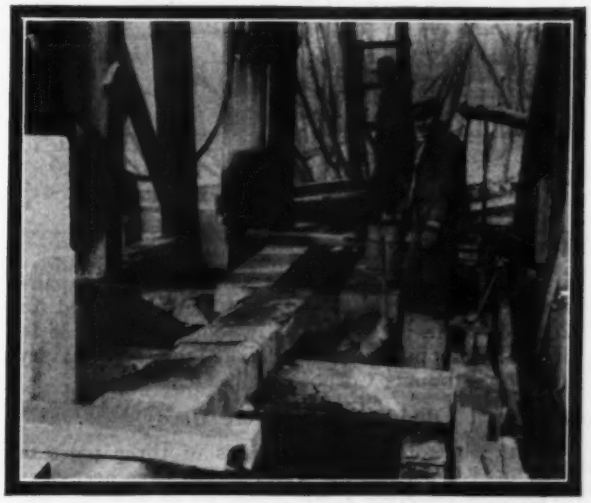


General Plan and Elevation of the Substructure

Michigan Central builds interesting structure to replace the old timber trestle near East Gary

A Drop Hammer was Used for Driving the Sheet Piling

for Ingenuity Renewal



A Close Up View of the Concrete Pile Driving

bridge would have on the stability of the old one until it could be taken out of service.

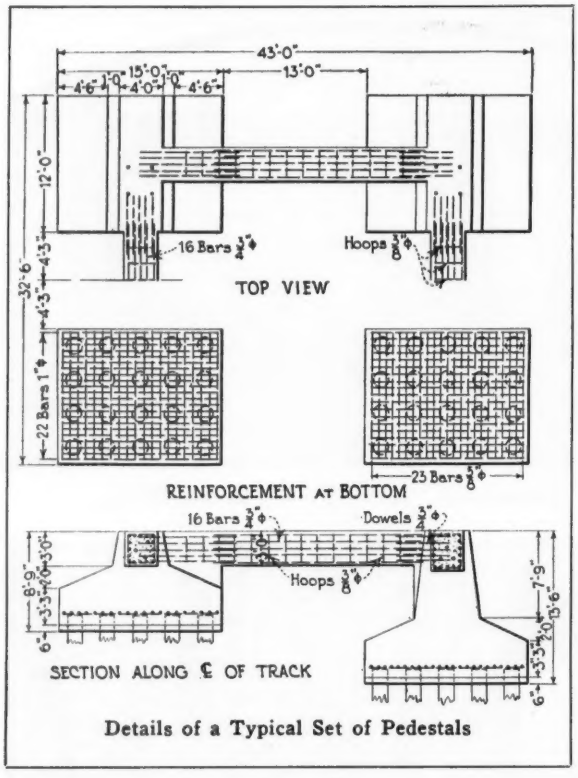
Owing to the limited bearing power of the foundation material, it was necessary to distribute the weight to be carried over the maximum area. This naturally pointed to the use of a short-span structure and one that imposed a minimum of dead load. Furthermore, it was desirable to adopt a design that entailed as little interference with the old structure as possible or in which the old structure imposed a minimum of obstruction to the construction of the new.

This led to the adoption of a steel-viaduct design with 28-ft. tower spans and 42-ft. clear spans (center to center of bents), with the bases of the bents or tops of pedestals 23.2 ft. below base of rail. Five lines of 36-in. Bethlehem I-beams are used for the span (35⅝-in., 147-lb. beams for the 28-ft. spans and 36⅛-in., 250-lb. beams for the 42-ft. spans). The bents are only 17 ft. 4½ in. high, but by placing the columns on a batter of two inches to the foot the bents have a spread at the bottom of 17½ ft., center to center of posts. This made it possible to provide separate pedestals for each column, which were far enough on each side of the center line of the bridge so that the foundation piles in the inside rows were 5 ft. 9 in. from the center line of track. Thus, the driving of the piles introduced a minimum of interference with the piles under the old bridge and permitted the driving of all new piles from the deck of the old bridge.

Pedestals Designed for Minimum Weight

To reduce the weight of the substructure to a minimum, the pedestals were made as low as possible, in the case of seven bents consisting simply of reinforced concrete slabs to distribute the load over the piles. For the five other bents the slabs are surmounted by walls four feet wide at the top and six feet at the bottom extending across the full transverse width of the slabs. Another distinctive feature of the design is the introduction of concrete struts connecting the four pedestals under each steel tower. The bridge terminates at each end in a concrete bank bent consisting simply of a bridge seat and back wall supported on piles, but to afford greater stability against lateral earth pressure of the embankment, inclined concrete struts were introduced to connect the abutments with the pedestals supporting the adjacent bents.

While all piles, except those supporting the bank bents, have their cutoffs well below minimum water level, it was decided to use concrete piles throughout, this decision being influenced by the apprehension that drainage work now in progress in the vicinity, or to be carried out in the future, might lower the water level at the bridge site. This decision was fraught with some anxiety, however, because of the indications that piles of excessive length would be required. A test pile driven near mid-length of the bridge sank into the mud for several feet under the weight of the hammer and when it was driven to refusal, its point was 105 ft. below base of rail. This indicated a pile length of 50 ft. from bottom to cutoff elevation, but on further study, it was decided that piles



Details of a Typical Set of Pedestals

of this length would be required only for four pairs of pedestals, and the final bill of material called for 128 piles, 50 ft. long; 212, 45 ft. long; and 200, 35 ft. long. These piles were furnished by the Massey Concrete Products Corporation, Chicago.

Puddle Walls Were Used

As the bottom of the footings of three pairs of pedestals is 8½ ft. below water level it was necessary to provide effective coffer-dams to permit the unwatering of the excavations. Puddle walls were used, with Lackawanna steel sheet piling on the inside and Wakefield piling on the outside, but the steel sheet piling was provided also for another purpose—to increase the stability of the pile foundations. The sheet piles, which were ordered 35 ft. long for the center pier and 20 ft. long for the two other piers, were driven in the first place only as deep as was necessary for use in the coffer-dams. Then, after the pedestals had been completed, they were driven down until their tops were flush with the tops of the pedestal slabs, thus forming a wall surrounding the foundation piles that provided added lateral support for the piers.

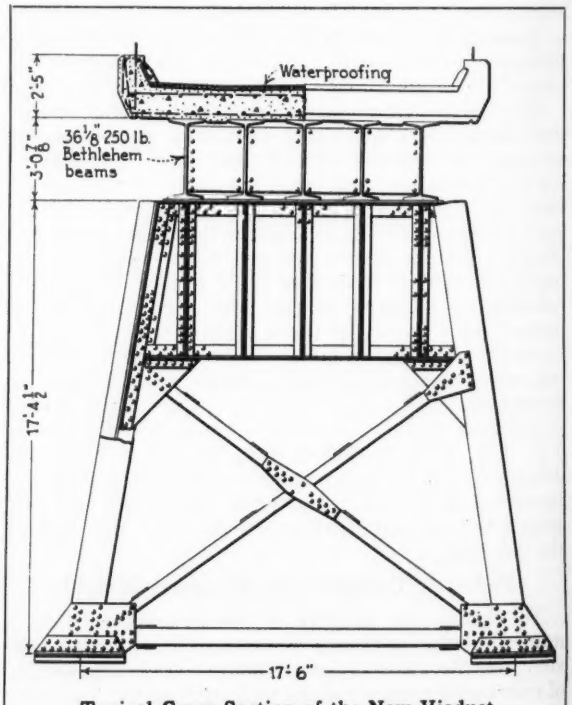
The construction work was distinctive by reason of the extent to which it was conducted with equipment operated on the deck of the old bridge. As seen in one of the illustrations, locomotive cranes were employed in driving both foundation and sheet piles and were also used with clamshell buckets in excavating within the coffer-dams and for filling the puddle walls. Concrete was delivered to the forms in cars hauled out on the structure from a mixer plant at the west end of the bridge by a Plymouth gasoline locomotive. A 24-in. gage track was provided for this equipment on the bridge by spiking an additional line of rails to the ties at 24-in. gage from one of the traffic rails. Interference with an average of 11 trains during the 9-hr. working day was reduced to a minimum by providing a spur track at each end of the bridge, one of 11 cars' capacity at the east end and another of 3 cars' capacity at the west end.

Pile Driving Displaces Material

Foundation piles were driven with a No. 2 Vulcan steam hammer in 40-ft. leads. Owing to the size and number of piles, the pile driving was accompanied by an appreciable displacement of material, this being calculated at 133 cu. yd. for one pier alone. To decrease the unbalanced lateral pressure on the piles under the old structure during this work, it was the practice to drive piles alternately on one side of the old bridge and then the other. Two cranes were normally employed in this work, one to set the piles on one side while the other was supporting the hammer and leads in actual pile driving on the other side. When setting a pile, it was dropped several times to form a hole to receive it and by the final drop it had generally settled about 30 ft.

As the reinforcing in the footing slab did not permit of any appreciable latitude in the elevation of the top of the pile, all piles that were driven to refusal before they were down to the assumed depth had to be cut off. This work was expedited by the use of an acetylene torch for burning of the reinforcement.

The concrete mixing plant, which was located adjacent to the spur track at the west end of the bridge, was of the conventional type in which the mixer is charged from a platform directly above it. Aggregates were stored in overhead bins and cement in a house close by, a locomotive crane being used in transferring stone and sand from storage piles to the bins, and the cement from the cement house to the charging platform with the aid of a skip. The mixer was erected high enough to dump concrete into 1¼-cu. yd. steel hopper cars which, after being



Typical Cross Section of the New Viaduct

hauled out on the bridge, were dumped into wooden hoppers for chuting the concrete to the forms through "elephant-trunk" chutes.

Has Concrete Deck

The I-beam spans of the bridge carry a reinforced concrete ballast deck composed of precast slabs, 15 ft. long (crosswise of the bridge) and 6 ft. 11 in. wide. The slabs were covered with membrane waterproofing with enough fabric projecting on each side to overlap the joints after erection. Pipes of 2½-in. diameter were cast into each slab at two places to provide drainage. These pipes are equipped with cast iron flanges at the top, set flush with the surface of the mastic protection for the waterproofing.

The bridge was designed by the engineering department of the Michigan Central, which also supervised its construction. The installation of the substructure was performed under contract by the D. W. Thurston Company of Detroit, Mich., and the superstructure was fabricated by the McClintic-Marshall Company, Pittsburgh, Pa.

An Attractive Station

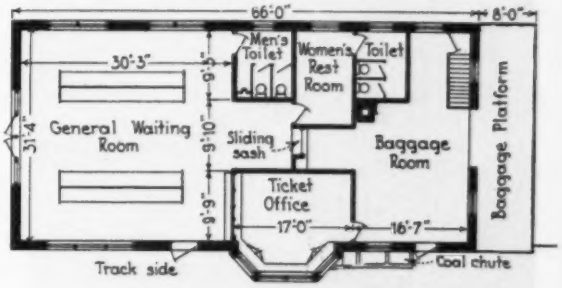
RUG texture brick, in five shades ranging from red to purple that produce a pleasing tapestry effect, and Anaconda copper-clad composition shingles, that give the appearance of weathered copper, are distinct features of an attractive station built by the Pennsylvania at Hartford City, Ind. The appearance of

The Hartford City Station

the building was further enhanced by bush hammering the surfaces of the precast concrete trim to show the small pebbles used for aggregate.

The station is a relatively small one, typical of those meeting the needs of the railways at the many small communities along their lines. The building is 66 ft. by 31 ft. 4 in. in plan and houses a general waiting room, 30 ft. 3 in. by 28 ft. 10 in.; a ticket office, 17 ft. by 9 ft. 9 in., exclusive of a bay window; toilet rooms; a small rest room for women; and a baggage room 16 ft. 7 in. wide with an average length of 24 ft. A basement under the baggage room houses the heating plant.

The shingles mentioned previously are slate-surfaced, asphalt rag-felt, thick-butt, strip shingles which have the portion exposed to the weather coated with copper which is treated to produce the green color of weathered copper. The upper corners of each shingle, where covered by the shingles above, are asphalt-coated, the space between being coated

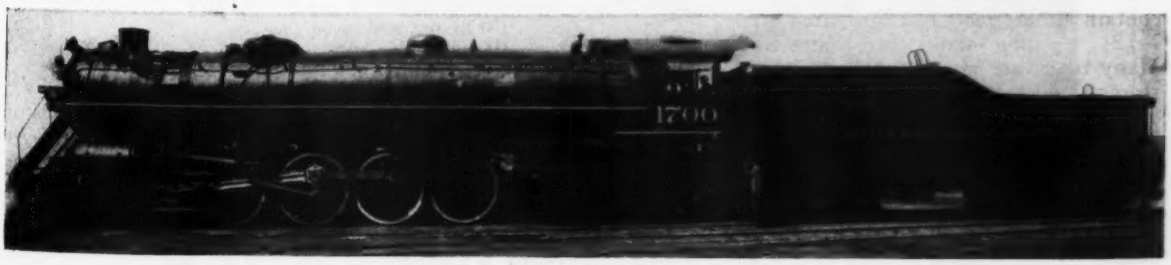


The Floor Plan

with untreated copper. The result is an attractive combination of green and copper color when the roof is first laid and will eventually turn to a more or less even copper green. The roof is enclosed at each gable by a parapet wall comprising an extension of the end wall. The gutters and downspouts are untreated copper.

The floors, except in the ticket office, are of concrete laid on fill, but over the basement the floor comprises a reinforced concrete slab on encased steel beams. The ticket office has a wood floor over cinder concrete. The ceiling and the walls above the wainscot are plastered, the walls having a buff tint to the level of the picture mould and ivory tint above. The wainscot is mosaic salt-glazed brick provided with a cap mould stretcher and internal and external square returns. The trim is pine stained and varnished inside to imitate mahogany and painted a medium gray on the outside.

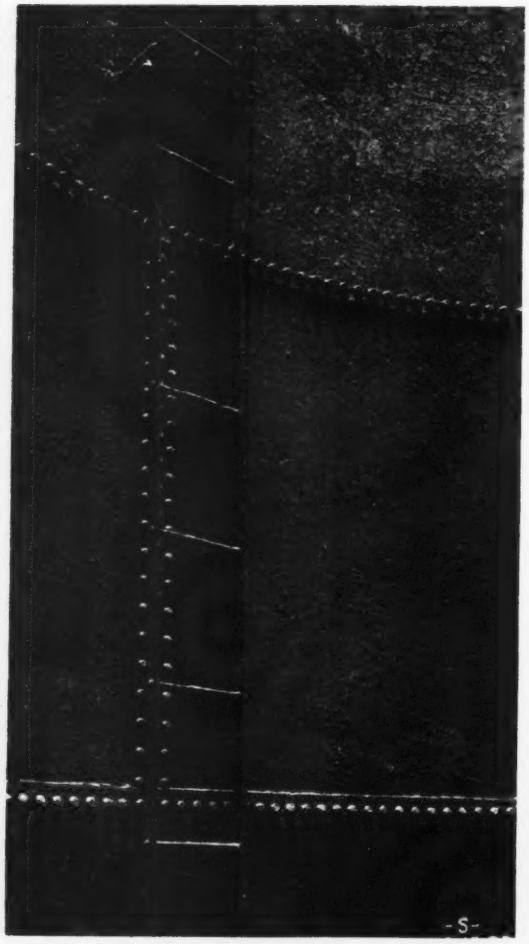
Shelter from the weather on platforms is limited to the overhang of the roof on the track side of the building, a moulded copper marquise over the entrance at the end of the waiting room, and a roof over the baggage platform at the opposite end of the building, as seen in the photograph. In addition to electric lighting of the interior, lighting fixtures are provided in the soffits of the roof overhangs and the ceiling of the shelters over the waiting-room entrance and baggage platform.



One of 10 New 4-8-4 Type Locomotives Recently Acquired by the Denver & Rio Grand Western

Six Methods of Preventing Corrosion of Tanks and Their Interiors*

A critical comparison of various means of protection and some definite recommendations



Interior of a Tank Painted with Cement
The tank was built in 1910, the cement grout was applied in 1918, the photograph was taken in October, 1923.

THE number of steel tanks in railway water service is rapidly increasing and the proper protection of their interior surfaces against pitting and corrosion has become a problem of considerable importance. For the purposes of this report the tanks are divided into three groups according to their use:

(1) Water storage tanks from which water is drawn for locomotives and general use. They may contain either treated or untreated water.

(2) Settling tanks for water-softening plants. Many tanks are now used as combined settling and storage tanks.

(3) Tanks used in connection with hot-water boiler-washing plants.

Since the quality of the water and its temperature are important factors in the corrosion of steel tanks and the effectiveness of protective coatings in retarding this corrosion, the three classes of tanks named above will be considered separately in the report.

Where the quality of the water is favorable, steel storage tanks have been in service 25 to 30 years without requiring extensive maintenance in the way of protective coatings and without any serious damage from corrosion. However, numerous cases are on record where tanks inadequately protected have required extensive repairs or have even failed in 15 years or less. In general, storage tanks suffer more from corrosion on the areas exposed alternately to the action of water and air on account of the varying water level. This is usually general corrosion or rusting over the entire surface, rather than pitting or grooving. The materials most commonly used for protecting the interior of these tanks are:

(1) Paints using linseed oil as a vehicle and various materials for pigment and filler.
(2) Asphaltic and coal-tar paint in liquid form.
(3) Asphaltic and coal-tar mastics which have to be applied hot.
(4) Materials with a petroleum-jelly base and usually containing some rust-inhibiting chemicals such as chromium salts.
(5) Emulsified asphalts.
(6) Portland cement grout.

Since paints containing linseed oil dry by oxidation, it is essential that such paints be allowed all the time possible for drying before being immersed. This is the chief objection to such paints, as it is usually impossible to keep a tank out of service long enough to insure the oxidation of the linseed oil sufficiently to insure a lasting protective coating. Special formulas of quick drying paints are desirable if other qualities are good, and the following is recommended:

100 lb. red lead in oil,
1½ gal. boiled linseed oil,
3 pints turpentine,
2 pints liquid dryer.

When the paint is ready to apply, add two pounds of finely powdered litharge to every gallon of paint. At least one week should be allowed between the priming coat and the second coat and at least 48 hours between the second and third coat and between the third coat and the time water is admitted to the tank.

Laboratory and service tests indicate that approxi-

*A report presented before the convention of the American Railway Engineering Association at Chicago on March 5.

Corrosion

*Underground Pipes**

mately three years is as long as a good coating of linseed oil paint can be expected to protect against pitting and corrosion.

Asphaltic and coal-tar paints in liquid form have the advantage of being rather quick drying and not requiring the tank to be kept out of service as long as the linseed oil paints. There are a great many such paints on the market and two or three that have recently been introduced have given good results, although they have not been in service long enough to permit definite conclusions being drawn.

Asphaltic and coal-tar mastics applied hot in coating of from ⅛ to ¼ in. in thickness over a priming coat of asphaltic paint have given very good service, as reports indicate that some of these coatings are in good condition after ten years' service. The cost of coating a tank with this material will be approximately three or four times greater than the cost of painting the same tank with red lead and linseed oil. However, the better protection afforded by the mastic and its longer life might make it more economical to use in many cases. Contractors will apply these materials and guarantee protection against corrosion for periods of from five to seven years.

Compounds with a petroleum-jelly base resembling vaseline, to which some such rust-inhibiting chemical as chromium salts has been added, have been highly recommended for the protection of the interior of water tanks against corrosion. The use of these materials as coatings for the interior of steel water tanks has not extended over a sufficient period of time to permit definite conclusions as to its value to be made. Enough favorable reports have been received, however, to warrant extensive trial applications being made.

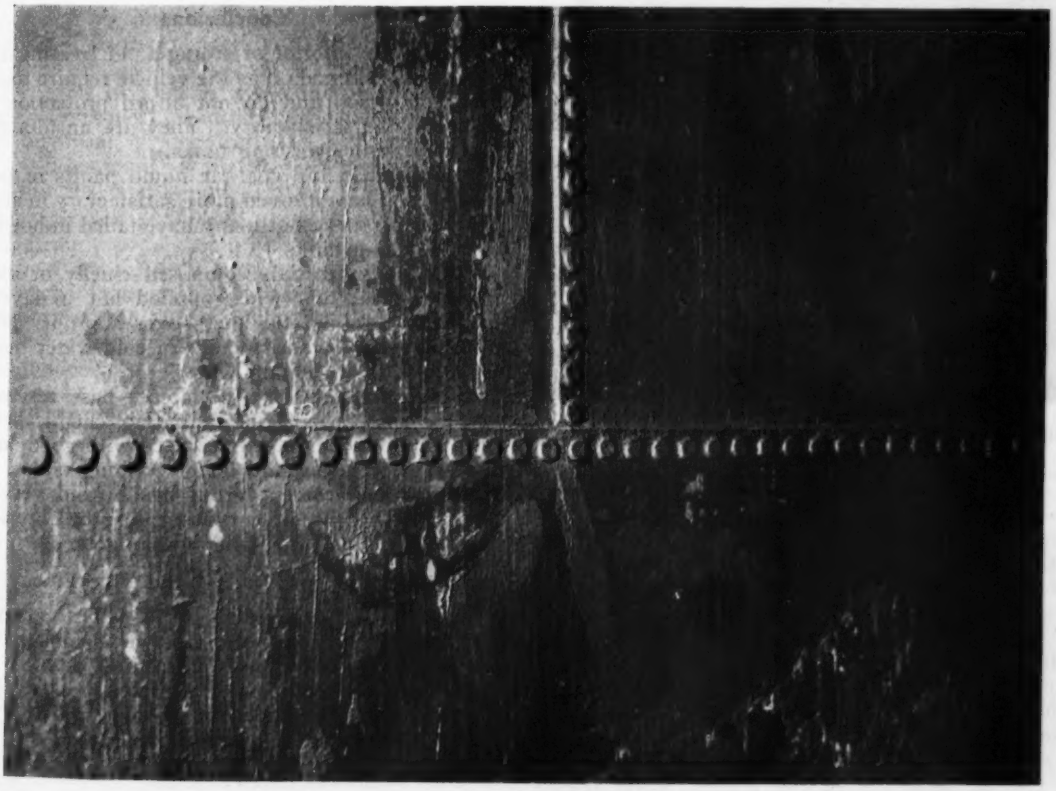
Emulsified asphalts have not in most cases proven satisfactory as protective coatings for the interiors of steel water tanks.

Two middle western railroads have made extensive use of portland cement grout as a protective coating for the interior of these tanks with gratifying results.

Instructions for applying this material as issued by one of these roads are as follows:

Cement grout mixture,
1½ parts by volume of portland cement,
1 part by volume of very fine sand,
Water sufficient to make a thick cream.

The tank should be drained and the lower course thoroughly cleaned before the cement grout is applied. This should be allowed to stand for an hour or two, then the second coat applied. After it has had another hour or so to set, the water can be run



Close Up View of Interior of Boiler Washing Tank After 18 Months' Service
The tank was coated with two applications of neat portland cement grout before being placed in service.

in to within a foot or so of the top of the coating and a raft supported by four barrels or floats can be made, for use as a scaffold in cleaning and painting the next course. The corners of the raft should be padded with burlap so that they will not mar the coating in case the raft jars against it.

The second course can then be cleaned and the grout applied in the same manner as the first course, and each course taken care of successively.

Important points are that only sufficient cement grout should be made up to apply before it takes initial set; and the mixture should be thoroughly brushed or stippled into the pits.

The grout may be applied either with a paint or whitewash brush and as much of it as will stick on is allowed to remain. The cost of applying the cement grout is a little less than the cost of applying ordinary paint. The material used costs much less but the labor required is slightly greater.

Inside of the Bottom of the Boiler Washing Tank After 10 Months' Service

Before being placed in service this tank had been given two coats of paint especially recommended by the manufacturer for this service.

The caustic alkalinity of water treated with lime and soda ash inhibits, to a certain extent, the pitting and corrosion of steel water treating tanks. In some localities it has been found unnecessary to apply protective coatings to the interior of these tanks, but in other places severe pitting has taken place.

The coatings above described as used in storage tanks have also been used in water treating tanks. The caustic alkalinity of the treated water makes linseed oil paints less durable in treating tanks than in storage tanks and the asphaltic paints and enamels, the petroleum jellies and the cement grout appear to be more suitable for this service on that account.

Steel tanks used in hot-water boiler-washing plants suffer more severely from corrosion, especially pitting and grooving, than either the storage or treating tanks. Serious corrosion has in some cases become evident after a few months' service, as evidenced in one instance, where the ¼-in. plate was completely eaten through in three years' time.

The quality of the water, especially in the wash-out tanks, and the high temperatures make the problem of protecting the interiors of these tanks very difficult. The paints using linseed oil as a vehicle are practically worthless in this service and many of the asphaltic paints have been tried without good results. The mastics will not successfully withstand the high temperatures encountered. The material composed of petroleum jelly with rust inhibiting chemicals has been used with success in at least one instance and offers possibilities warranting further test applications.

The use of cement grout has also proved to be of value. Two new boiler-washing tanks painted two years ago with neat portland cement grout are now in practically perfect condition except for the underside of the roof or cover. Most of the grout has scaled off the cover, due, perhaps, to the vibration of this part of the tank. One of the advantages of the use of cement grout is that any small defective places can be easily detected and patched. In applying the grout to the two tanks described above, one coat was first applied and then a small jet of steam was allowed to enter the tank, to keep the cement moist until it obtained its final set. The second coat was then applied and kept damp with the small steam jet for 10 or 12 hours.

Conclusions

1. For the interior of storage and treating tanks, paints using linseed oil as the vehicle require too long a drying period and do not afford protection long enough to be satisfactory. They are unsuitable for hot-water boiler-washing tanks.
2. Asphaltic and coal-tar liquid paints of proper composition have proved more satisfactory in storage and treating tanks but many have failed in hot-water boiler-washing tanks.
3. Mastic materials composed chiefly of asphalt and coal-tar pitch, when applied hot in layers of 1/16 in. to ⅛ in. in thickness over a proper primer, have proved very satisfactory in cold water but will not stand up in boiling water.
4. Preparations of a petroleum base resembling vaseline into which rust-inhibiting chemicals have been compounded, have been used with good success in storage, treating and boiler-washing tanks.
5. Portland cement grout has proved very successful as a protective coating for the interior of storage, treating and boiler washing tanks.

Coatings for Undergound Pipe Lines

Steel pipe laid undergound usually is corroded very rapidly. The rate of corrosion depends upon the character of the soil and the ground water.

The life of such pipe can be materially lengthened by applying some protective coating.

The coatings most commonly used are:

(1) Paint.
(2) Bituminous, dipped or poured.
(3) Bituminous, reinforced with fabric.
(4) Petroleum-jelly base preparations.
(5) Portland cement.
(6) Metallic.

In general, red lead, zinc and graphite paints mixed with linseed oil are not suitable for underground use. Paints with a coal-tar or asphaltum base are most frequently used and have given better results. One coat of paint is not sufficient to protect the metal for any considerable length of time except in very slightly corrosive soils. Paints reinforced with some filler such as asbestos fibre so that a thicker coating may be applied are more desirable. To be of practical value against underground corrosion, a non-porous coating of substantial thickness is required. Pipe protected with paint will probably last two years longer than unprotected pipe.

Bituminous Coatings Widely Used

Bituminous coatings consist of refined coal-tar pitch and asphalts with various fillers. These coatings are applied either by dipping, pouring or mopping. Dipping is done at the pipe mill in a tank of hot compound. Single dip coatings average about $\frac{1}{32}$ in. in thickness and are only suitable for mildly corrosive soil. In applying a bituminous coating in the field, the pipe is first given a priming coat of the same base as the outer coating and allowed to dry. The outer coating is then poured on top of the pipe and the surplus that drains off the pipe is caught in a canvas sling under the pipe. The sling is then brought in contact with the bottom and sides of the pipe and is pulled up and down, so that the pipe is uniformly covered with the material. In this way a coating may be applied up to ¼ in. in thickness. Such coatings will extend the life of the pipe from three to four years.

When corrosive conditions are severe, bituminous coatings can be reinforced with a fabric, such as burlap, rag felt or asbestos felt which will improve their resistance to abrasion and corrosion.

Reinforced coatings may be applied at the pipe mills or in the field. Application at the mill affords better control of materials and inspection, but the coating is subject to injury, especially in laying screw pipe and in shipping. An additional wrapping must be made in the field at the coupling or weld after the pipe is laid.

When reinforced coatings are applied by hand in the field, the pipe is first given a priming coat and allowed to dry. Next a coating of asphalt or coal-tar cement is poured or mopped over the entire circumference of the pipe. While this coating is still hot, the fabric is wound around the pipe and the lapped joints sealed with the cement. Over the wrapping, another coating of cement is applied. In this manner, two and sometimes three layers of covering material may be applied. Reinforced bituminous coatings may be expected to prolong the life of pipe from five to seven years.

Good results have been obtained in protecting pipe lines against corrosion by the use of a preparation of petroleum base, into which rust-inhibiting compounds such as chromium salts have been introduced. It is non-hardening, resembling vaseline or axle grease and is made in several degrees of consistency. To be effective, it should be protected by a fabric wrapper and the application is made in a manner quite similar to the process above described for reinforced bituminous coatings. However, as the petroleum jelly does not have to be melted, it is swabbed on and distributed over the pipe, its application being easier than in the case of reinforced bituminous coatings and also cheaper.

A good rich grout of portland cement properly applied is the most permanent protection against underground corrosion yet devised. The cement grout is most economically applied with the use of steel forms in which the pipe has been centered. A grout consisting of one part of cement to two parts of clean sand is thoroughly mixed and poured into the forms, so that the coating will be about two inches in thickness. A bituminous priming coat should be applied to the pipe first. This type of protection is very expensive. Oil pipe lines in salt marshes have been protected in this way for over 25 years with but little maintenance.

The metallic coatings commonly used for protecting pipe lines against corrosion are zinc and lead and are applied at the mills. In general, better and more economical results can be obtained with non-metallic coatings than with metallic coatings for underground pipe line protection.

Summary

A rough estimate of the increased life in years that may be expected by the use of the coatings described above and a comparison of the unit cost of each, taking paint as the basis, is given below:

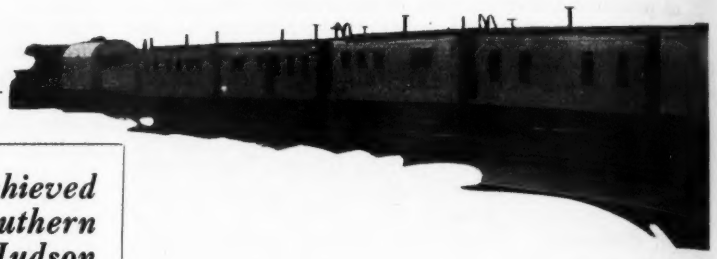
Coating Used	Increased Life in Years	Unit Cost
Paint coatings	2	1
Bituminous coatings	4	4
Bituminous coatings, reinforced, wrapped	5–7	6–9
Petroleum jelly base compound, wrapped	5	5
Metallic coatings	4	15
Portland cement coatings	20	30

The application of protective coatings to underground pipe lines is a question of economics and if choosing a coating for any particular location, the various factors such as permanency of the line, importance of uinterrupted service, accessibility, character of soil and cost of protection should be carefully considered.

Chicago, Milwaukee, St. Paul & Pacific Bridge Over the Missouri River at Mobridge, S. D.

Setting the Pace

In Designing and E



Outstanding results achieved by the Kansas City Southern and the Delaware & Hudson in housing floating gangs

WHILE the improvement of outfit-car equipment on American railways has been marked by great progress in the last few years, as was shown by a review of this subject in the May issue of *Railway Engineering and Maintenance*, it has remained for the Kansas City Southern and the Delaware & Hudson to demonstrate what can be done to attain outstanding results in the design and equipment of these cars to provide facilities for comfort, cleanliness and sanitation for their occupants. That the railways as well as the men have profited from these measures is thoroughly established.

These facilities include shower baths and lavatories with hot and cold running water, hot-water heating systems and electric lights, in addition to lounging rooms equipped with tables and seats, where the men may spend their time off duty in reading or other diversions. Aside from these features, which are found in the camp cars on each of these roads, the K. C. S. has installed chemical toilets in its washroom and in the foreman's car, and the D. & H. has provided electric fans in its cars. While some of these various improvements are found individually in camp cars they have been combined by these roads to form outfits remarkably complete in all their details.

In working to a common end, the two roads have proceeded along somewhat different lines, in that the K. C. S. has constructed new car bodies in which the framing is made to conform to predetermined locations for doors, windows and partitions, and the bodies are erected on steel underframes salvaged from burned or otherwise damaged cars, while the D. & H. has remodeled old passenger cars to secure the desired results.

The Kansas City Southern Camp

THE K. C. S. outfit here described was built for a pile-driving gang, but it is the intention to provide similar facilities for other bridge and building forces, such as bridge gangs, house carpenter gangs and painting gangs as soon as means are available. No attempt will be made to provide similar outfits for floating track gangs, since it is intended eventually to carry on all track work exclusively with section gangs and thus avoid the use of cars entirely.

The assembly consists of seven cars, made up into a train in the following order:

1 Foreman's car
1 Combined kitchen and dining car
1 Recreation and bath car
1 Bunk car
1 Tool car
1 Supply car for coal and water
1 Flat car for piles

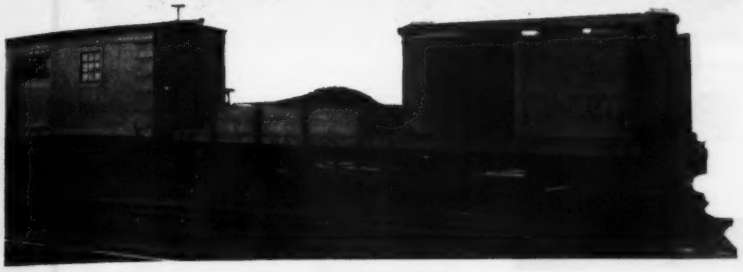
Facilities for Comfort, Cleanliness and Sanitation

The exteriors of all cars are painted a battleship gray, with black lettering.

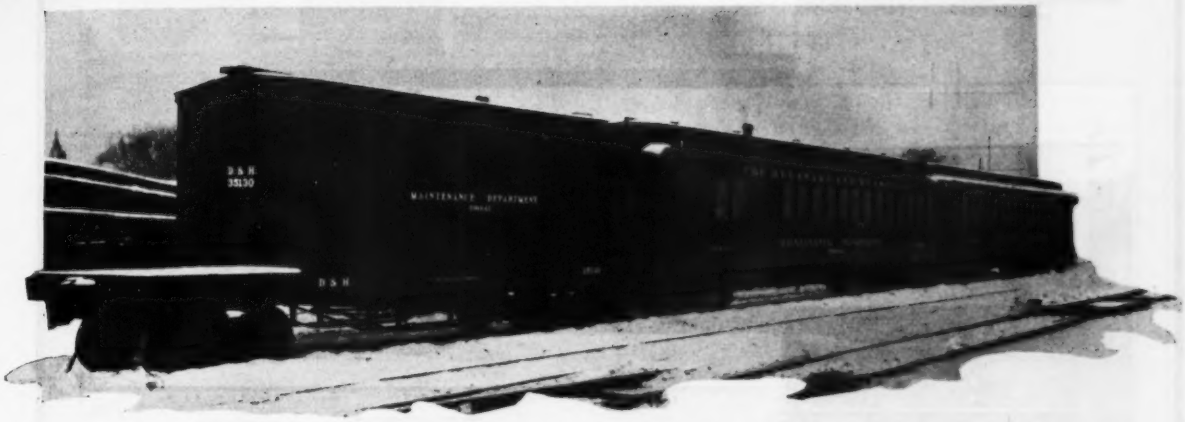
All of the cars, except the tool car, are heated by hot-water radiators supplied from an Arcola heater in each car, and all of the house cars are lighted by electricity generated by a Delco light plant housed in the kitchen. One end of the recreation car is partitioned off to form a bathroom, containing two shower baths and three lavatories, while the foreman's car also has a bathroom with a lavatory and stationary tub. Each of these bathrooms is equipped with a toilet connected to a Kaustine chemical septic tank underneath the car.

In constructing the bodies, the sides and ends were covered with standard siding, with a layer of two-ply tarred felt underneath. The floor is of two courses, the subfloor being of standard 1¾-in. decking laid laterally, and the top floor of tongue and groove yellow pine laid lengthwise of the car. The roof is of two courses of standard tongue and groove roofing laid laterally, and both the floor and the roof have a layer of two-ply tarred felt between the courses. The interiors of the house cars, except the tool car, are lined on the ceiling, sides and ends with Celotex fastened to the framing, with coach headlining battens at the joints. The Celotex is brought to the frames of the doors and windows, where it is covered by the fascia, and is also brought down to the floor line, being faced at the bottom with a six-inch baseboard. Quarter-round moulding is used at the intersections of the walls and ceiling. The windows are of standard double-sash coach type, with standard coach window catches. The window sashes are of oak, finished in the natural color, and all interior woodwork in the partitions, lockers, baseboard, etc., is of yellow pine, also finished in the natural

Equipping Camp Cars



At the left—Camp outfit for a pile-driving gang on the Kansas City Southern. Below—Typical outfit for a small floating gang on the Delaware & Hudson.



color. Yellow-pine paneled doors are provided at each end of each car and the dining car, in addition, has a door on each side near the center of the car. All doors and windows are screened.

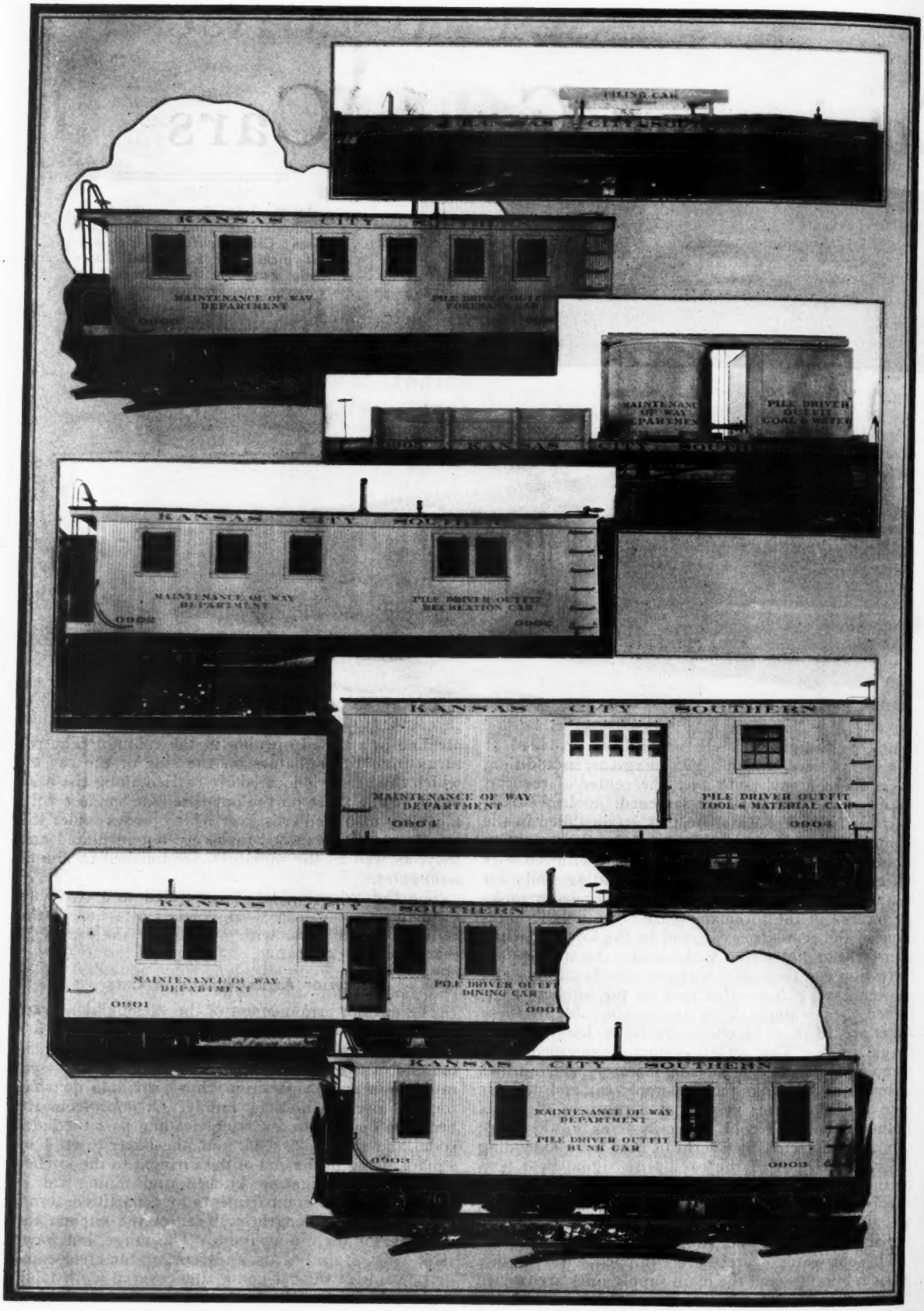
Arcola No. 5 hot-water heaters are installed in the dining room and the bunk car, while the recreation car and the foreman's car are equipped with No. 8-H heaters of the same make, with heating coils for heating the bath water. Overhead cold-water tanks are located in the foreman's bath-room, in the bath-room of the recreation car, and in the kitchen, while an overhead hot-water tank is also located in the recreation car to supply water to the lavatories and showers, and a hot-water tank in the kitchen is attached to a waterback on the range. All of these tanks are 18 in. in diameter by 60 in. long, holding 65 gal. each. The water system is supplied by a pump, operated by the Delco generator, which draws water from the tanks on the supply car and delivers it to the cold-water system at a pressure of 15 lb. Both the hot and cold water systems in the three cars are connected by overhead pipe lines extending through the ends of the cars, with signal hose connections between the cars, while heavily-insulated supply pipes, connecting the tanks with the pump, are attached to the underframes of the cars, with signal-hose connections from car to car.

The hot-water heaters are equipped with thermostatic regulators and the main supply lines are carried overhead with laterals connected to drops to the radiators. An expansion tank, fitted with a gage glass and properly vented, is located above the supply line in a boxed opening in the ceiling. The returns from the radiators on the side of the car on which the heater is located are carried along the base board, while those on the opposite side connect with a heavily insulated crossover which passes under the top floor. The exposed pipes are not insulated and they, as well as the radiators, are finished in aluminum color.

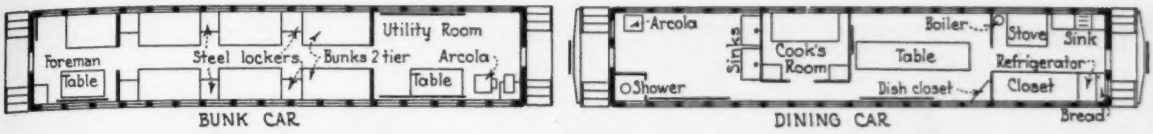
The Delco light plant is connected to a two-wire train line carried in a ½-in. conduit attached to the ceilings of the cars, with outlets for the lamps at the desired locations.

Interior Arrangements of Cars

The interior arrangement of the various living cars is shown in the accompanying plans. The foreman's car contains a living and office room, 13 ft. long, in the end of the car, with a bedroom 10 ft. long, separated from it by a partition, thus providing quarters for the foreman and his family. A door from the bedroom opens into a corridor leading past the bath-room and the cook's bedroom, the latter, 6 ft. 4 in. square, being in the end of the car next to the kitchen car. The combination kitchen and dining car is divided into two compartments by a partition across the car, giving a length of 19 ft. for the kitchen and of 20 ft. for the dining room. The range, hot-water tank, sink, drain boards, and refrigerator are located on one side of the car and a zinc-covered work table, with lockers beneath for the storage of supplies and utensils, a dish cupboard, and the Delco light plant are on the other side. The dining room has a table



Views of the Various Units of the Kansas City Southern Floating Gang Equipment



How the Delaware & Hudson Lays Out Old Passenger Cars for the Use of Floating Gangs.

3 ft. wide by 10 ft. long, with seats for 12 men.

The recreation car is likewise divided by a cross partition, providing a recreation room 21 ft. long, equipped with a desk, table and seats, and a toilet room 17 ft. long. Besides the toilet facilities, which have been described, this car also contains lockers for the men.

The bunk car has four single-deck and four double-deck collapsible steel bunks with mattresses, the bunks being located in the ends of the car, leaving an open space in the center, part of which is occupied by the heater and coal box.

The tool car is lined on the ceiling, sides and ends with tongue-and-groove yellow pine and has one window on each side at one end of the car, and a sliding door at the center of the car on each side. A work bench, 8 ft. long, is located on one side of the car beneath the window, and between the bench and the end of the car are two full-height lockers with three shelves for tool storage. Opposite the lockers is a tool rack extending from the floor of the car to the ceiling.

On the Kansas City Southern, the foremen of the bridge and buildings gangs handle the boarding of the men, since the forces are small. The foreman is thus in charge of the housekeeping of the cars as well as the work of the gang, and is held responsible for seeing that proper conditions are maintained.

The D. & H. Facilities

WITHIN the last few years, the Delaware & Hudson has replaced almost all of its box-car camp equipment for bridge and building, signal and telegraph, and floating track gangs, as well as a student engineering gang in the summer, with converted passenger cars, which are heated by hot water, lighted by electricity and cooled by electric fans, and which provide recreation rooms for the men, together with shower baths and wash sinks with running hot and cold water. Normally 20 camps are maintained, housing from 350 to 400 men.

Each outfit consists of a combined kitchen, dining and lavatory car, a water and fuel car, as many bunk cars as may be needed to care for the men in the gang and a tool car. The kitchen, occupying one end of the car, is 15 ft. long and contains a range, a refrigerator, a sink with drain boards and a large supply cupboard, together with two overhead water tanks with a capacity of 55 gal. each, and a hot-water tank adjacent to the range.

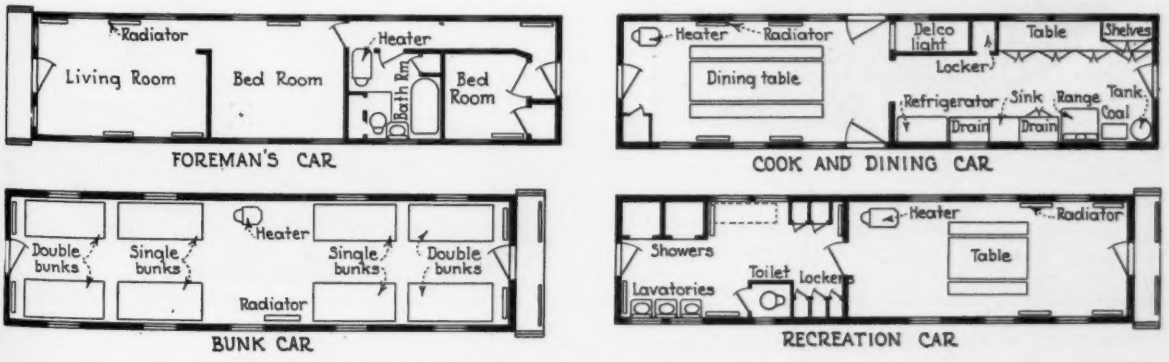
The dining room, 16 ft. 6 in. long, is separated from the kitchen by a cross partition and contains a long table with a frame constructed of metal pipe and with a Monel metal top. Straight-back chairs are used so that the cook has plenty of room to serve the men at the table. Next beyond the dining room, a room 9 ft. long by 6 ft. wide is partitioned off for sleeping quarters for the cook and orderly. This room is equipped with a double-deck steel bunk and two steel lockers. A corridor from the dining room leads past the cook's room to the lavatory and shower-bath room, which contains two wash sinks and a shower bath, with two overhead tanks of 55-gal. capacity each, for supplying hot and cold water.

The bunk car is divided into three compartments by cross-partitions, a room for the foreman occupying one end of the car. This room contains a table, a chair and a steel locker on one side of the car and a steel bunk on the other side. The sleeping quarters for the men contain six double-deck steel bunks, affording accommodations for 12 men, with two-compartment steel lockers at the end of each bunk, providing a place where each man can keep his clothes and other belongings under lock and key. All of the bunks in this car, as well as the bunk for the cook and orderly, are collapsible to permit thorough cleaning of the cars. At the end of the car beyond the bunks is a lounging or reading room, equipped with tables and chairs.

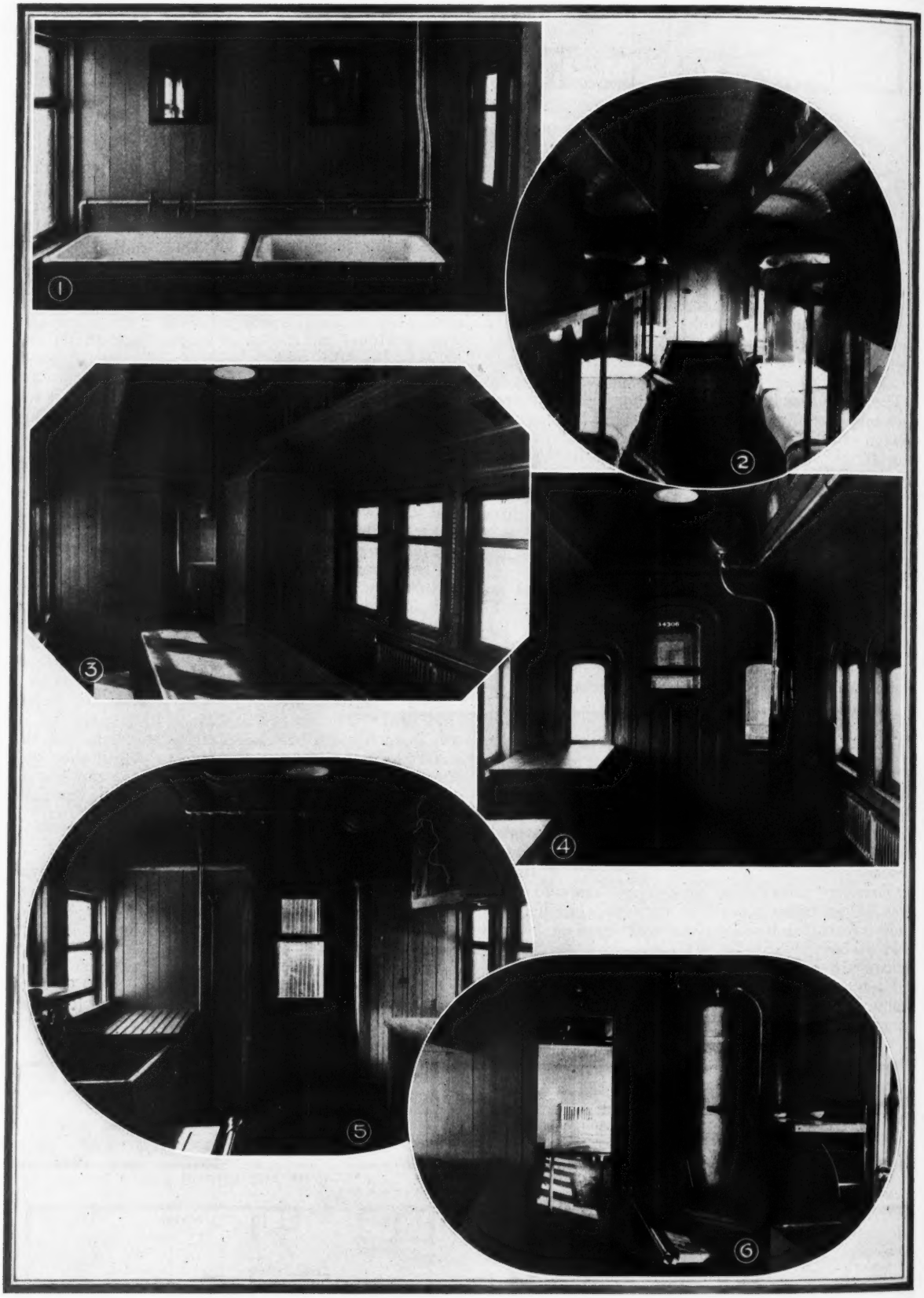
The Equipment of the Cars

Each car is heated by an Arcola heater, with wall radiators as required, the heater for the bunk car being located in the lounging room, while that for the dining and lavatory car is placed in the lavatory compartment.

The water and fuel car is equipped with an old locomotive tank with a capacity of from 5,000 to 7,000 gal. of water, and also carries an 800-watt capacity electric plant which delivers 110-volt current for fur-



Floor Plans of Typical Units of Kansas City Southern Camp Cars.



Typical Interior Views of Delaware & Hudson Camp Cars

(1) The lavoratory. (2) In the bunk car. (3) The table in the dining car has a Monel metal top. (4) The utility room in the bunk car contains the heater. (5) and (6) Two views in the kitchen.

nishing light, as well as power for electric fans, electric tools and for an automatic electric pump of ¼ hp. capacity which supplies the cars with water. Each compartment in the cars has one or more electric lights. The dining room and kitchen are each provided with an electric fan, while the bunk car has two fans.

The commissary arrangements vary with the size of the gangs, the smaller gangs handling this by a co-operative plan, while the floating track gangs are fed by contract, the railroad in either case furnishing the entire equipment, together with a cook and an orderly. Frequent inspections are made of the camps by the supervising officers of the division on which the camps are located and also by inspectors from the personnel department. Any unclean or unsanitary conditions are thus readily discovered and corrected and any complaints of the men as to food or living conditions are brought before the proper department for further investigation and correction.

The improvements in camp facilities on these roads have resulted in considerable economy, since the men, appreciating the comforts provided, become more permanent, experienced and loyal employees who are available for transportation to any point on the line for either emergency or regular maintenance work.

A Convenient Record for Handling Ballast

By A. C. Newing
Colfax, Cal.

WHEN two or more ballasting jobs are under way on one district in addition to the ordinary and emergency requirements, it is essential to maintain an accurate record of the cars being unloaded at various points, as well as to have a record at all times of such cars as are under load, together with their location. A compact, yet adequate, method of keeping these records is shown herewith on sample pages which were taken from a standard bound book with pages 8½ in. by 14 in.

The record is started by ruling two facing pages in the book, each of which is given the same page number. The left-hand page is used to show a record of the cars received, while the right-hand page shows information as to unloading. The first right-hand page in the book beneath the right-hand page of the record is also given the same page number, followed by the suffix "D," so that, by means of a sheet of carbon paper, a duplicate of the right-hand page, or unloading record, is made as the data are entered. This permits the removal of the original record of unloading for forwarding to the accounting department while the carbon copy is kept in the book as a duplicate record, the back of which is used as the left-hand or receiving side of the following page. After the first pages are ruled, the lines for the succeeding pages can be traced quickly by the use of a carbon sheet.

A shipping notice covering a consignment of ballast is entered on the left-hand side of the page, complete except for the waybill number and weight, which figures are left until the arrival of the waybill, when they are entered, indicating that the car has been received. Entries on the right-hand page are made as often as reports of unloading are received.

In maintaining a record in this manner, one has before him at all times a complete record of cars billed, cars under load, and cars made empty, showing where

ROCK AND GRAVEL RECEIVED IN DECEMBER 1928

ITEM	S/N	S/N DATE	CAR	NUMBER	W/B	WT. OR AMT.	SECTION	BILLED TO	REQN.
Wyo	1005	11-19	Sp	12831	449	25 y	18	Colfax	SA 12273
				10688	450	25 y			
				10654	451	25 y			
CRG	5066	11-26	Sp	12580	62	115900	21	Alta	SA-L54
				10908	63	116000			
				12317	64	117200			
Wyo	G1061	12-3	Sp	10712		25 y	18	Colfax	E.
				10583		25 y			
				12794		25 y			
				10485		25 y			
				[illegible]		25 y			
CRG	5083	11-30	Sp	12858	75	114700	21	Towle	SA-L54

Abbreviations

WYO Wyoming gravel
CRG Coast Rock and Gravel Co.
PRK Prattrock
S/N Shipping notice
W/B Waybill
AMT Cu yards
Wt - Pounds
REQN. Requisition

ROCK AND GRAVEL UNLOADED IN DECEMBER 1928

DATE U/L	TRK.	M.P. LOCATION		ST.	SEC.	WT. OR AMT.	GMO	R/N DATE	R/N No. F4293		REPTD TO ATR/CEK
						25 y		11-19	G1005	Fwd Nov.	
						25 y		✓	✓	✓	
						25 y		✓	✓	✓	
12-6	WB	158	159	1	22	115900	Storm ord	11-28	398805	✓	12-7
12-5	WB	156	157	1	21	116000	72462		398806	✓	12-7
12-5	EB	156	157	1	21	117200	72462		398807	✓	12-7
						25 y		12-3	G 1061	RQ McC	
						25 y			✓		
						25 y			✓		
12-4	St.	Std Oil Spur		1	15	25 y	Private Indstry		✓		12-4
						25 y			✓		
12-6	EB	109	110	2	12	114700	ord rps	12-5	398808		12-7

Abbreviations

U/L Unloaded
TRK. Eastward or Westward track
ST. Siding
M.P Mile post
R/N Receiving record
GMO Charge ℅

The Ballast Record Form

and when they were unloaded and for what purpose they were used. At the end of a period, the cars remaining under load are transferred to a new page (preferably in red) which enables one to keep the record in the manner of a perpetual inventory.

Take Time for the Little Things

Most of us remember the old copy books that we used in school thirty or forty years ago. And how hard we worked to imitate the fancy writing in those books. We screwed our faces up in knots, chewed our tongues and grew rigid in our efforts; and then when the sentence was finished it did not look much like the copy but rather like something the cat dragged in.

There was one thing in those old copy books that should have stayed with us, not because it improved our scrawl but for the sermon it contained. Remember the sample sentence, that said, "Mighty oaks from little acorns grow". "Nuts", says some fellow in the back row, "What of it, any boob knows that if you plant an acorn you ill get an oak--barring floods, fires, and famines."

What the old boy who edited the copy book was trying to get through our noodles, however, was the fact that big results come from small efforts, also that a little neglect will result in much damage.

It is fine to have your section rebuilt or to have Santa Claus bring the extra gang to you and fix things up in good shape. It is a real pleasure to know that everything is in fine condition, just like you had been wanting it to be for so long.

Yet there are lots of foremen with first-class sections who never see an extra gang. In fact their conditions do not justify the use of an extra gang for everything is in such good shape. Why is this? Simply because these foremen watch the little things and correct them while they are yet small, hence they never have any big things to worry them.

You, too, regardless of what your conditions are, can work yourself out of a bad hole by taking time to check the damage that comes from letting little things grow into big ones. Take time for the little things.

How One Division Engineer Talks to His Men
One of a series of monthly bulletins addressed to the foreman on the Northern division of the Frisco

Centralized Control

The Key to Success of Equipment

Two chief engineers outline methods and policies pursued in the administration of power facilities

TWO contributions, requested for the March or Labor Saving Issue of *Railway Engineering and Maintenance*, were received too late for publication in that issue, and for want of space could not be included in the April issue. Because they comprise a valuable addition to the discussions appearing in the March number, we present them here. The first of these, a brief statement by G. W. Harris, chief engineer of the Atchison, Topeka & Santa Fe System, appears next below, while a more detailed analysis of Pennsylvania practices by J. B. Baker, chief engineer maintenance of way of the Central region of that system, is presented under a separate heading.

These statements of the policies and practices of two great railways systems are of particular interest because they follow two different schools of thought with respect to the handling of repairs. On the Santa Fe, the repairs are made in the mechanical shops, while on the Pennsylvania they are conducted in shops provided especially for the handling of maintenance of way equipment. Each plan has its particular advantages and both have proved successful under favorable auspices. Mr. Baker's contribution also embraces an excellent outline of the thorough system of supervision maintained on the Pennsylvania to insure the greater return for the investment in work equipment.

Statement by Mr. Harris

It is our general practice to have all necessary repairs to work equipment and labor-saving devices made in our mechanical shops and this, in our opinion, seems a more practical method than to provide a special maintenance of way shop for taking care of this equipment. We have, on each general manager's territory, a central shop where we endeavor to make repairs during the winter months in order to insure that the equipment is kept in service during the working season. In these designated shops we maintain special facilities for making repairs, and endeavor to have the work handled by competent men who are familiar with this class of equipment. At times when no extraordinary repairs are involved, we find it advisable to make repairs at the divisional mechanical shops rather than go to the expense of bringing all the equipment to the central shop on each general manager's territory. Minor repairs necessary during the working season are usually taken care of in the field or in the divisional mechanical shops.

A supervisor of work equipment on each general manager's territory has charge of the assignment and maintenance of this class of equipment, and when equipment is shopped for repairs, he usually goes over the details of such repairs with the mechanical superintendent. The latter makes estimates of cost, and in the case of the older equipment, this estimate forms the basis of his recommendation as to whether it should be repaired or scrapped. We also have a chief motor-car maintainer who keeps in personal touch with the motor cars on the line and assists in outlining and directing the work of the motor-car maintainers.

We believe it is preferable to handle such work in the mechanical shops, if proper co-operation exists, rather than to provide special maintenance of way shops which would require more supervision and overhead and would be less economical It is our practice to keep in these general repair central shops, in charge of the supervisor of work equipment, a stock of those repair parts for which we have frequent calls, and whenever repair parts are needed, they are supplied from this stock. We do not attempt to carry in stock any parts which do not ordinarily wear out or break easily, and in cases where such parts are needed, it is necessary to order them from the manufacturer.

In general, we feel that the repair of maintenance

of way equipment and applicances can best be handled by the regional organization and, for this reason, there is some variation in practice in the several general managers' territories, but as a rule, all maintenance of way equipment falls under the jurisdiction of the mechanical department on being shopped.

The Control of Power Maintenance Equipment

By J. B. BAKER

Chief Engineer Maintenance of Way, Central Region, Pennsylvania, Pittsburgh, Pa.

THERE has been a vast increase in the number and kinds of machines and appliances introduced to increase the productivity of labor in maintenance of way work. This increase is due largely to the high standard of performance required of the railroads to meet the keener competition now prevalent in all activities, including transportation. The increase is also due to the remarkable development in the various machines that are adaptable for use on the tracks and along the right-of-way for work which was formerly done chiefly by labor with hand tools at a cost no longer permissible.

On the Central region of the Pennsylvania, the number of power machines and appliances has increased steadily from year to year until now there is a total of more than 1,500 units, consisting of locomotive cranes, ditchers, crawler cranes, rail cranes, large tie-tamping outfits (both air and electric), air compressors for master carpenters, motor cars, power cars, spreaders, dump cars, track cleaners (both sweeper and suction types), track skeletonizers, mole ballast cleaners, snow plows and flangers, auto trucks, tractors, weed-mowing equipment, platform sweepers, power rail layers, power rail drills and saws, bonding drills, concrete mixers, post-hole diggers, paint sprayers, pile drivers, hoisting equipment and pumps. The machines and equipment are distributed over 3,200 miles of railroad, divided into 12 divisions, on which there are 56 supervisors and over 1,000 foremen.

The machines and equipment represent a heavy outlay in capital, and a high efficiency in performance must be obtained to effect savings that will compensate for the investment made. To secure profitable performance it is necessary to keep the output of each machine near its maximum by steady, uninterrupted operation over as long a working period as practical.

The General Policy

An economical output from the numerous machines and appliances is obtained by the following policies and practices:

1. Programs are prepared covering the work to be done in accordance with the yearly budgets.
2. Machines are assigned to a specific schedule of work included in the programs, but the machines are not regularly assigned to divisions.
3. An accurate record is kept of the assignment for each machine.
4. Each machine is inspected, and put in good condition after finishing one schedule before being re-scheduled.
5. Major machines that are assigned for a working season are put in charge of an operator who remains with the machine.
6. Minor field repairs are made by the operator, heavier field repairs by the division maintainer, and general overhauling at the maintenance of way equipment shops.
7. Repair parts, when needed, are obtained by telephone request from the central storehouse.
8. Periodic inspections are made by division maintainers, as to condition, the care being given, and the method of operation. The machines are also inspected by regional inspectors.
9. Daily reports of performance are required of operators. Monthly reports are required of divisions, and yearly reports of the general divisions.
10. Machines, the work of which is seasonable, are started as early in the spring and worked as late in the fall as practicable.
11. In the long daylight days of midsummer, machines are worked extra time.
12. An attempt is made to select, for general work, machines that have been fully developed and found satisfactory for the service desired.

A program is prepared by the divisions, subject to the approval of the general officers, covering the amount of rail to be laid, the miles of track to be tamped, the miles of intertrack space to be cleaned, the ditching to be done, the weeds to be cut in locations where machines can be used, the buildings and bridges to be repaired and painted, and numerous other items of work.

Scheduling the Machines

To take care of the work, the machines are scheduled and assigned to the divisions for specific work in particular locations. Such machines as cranes, tie-tamping outfits and ballast cleaners are usually assigned for the season. Other machines, such as pile-drivers, spreaders, dump cars, and paint sprayers are assigned only for short periods. In assigning a machine, the time is set when the machine is to go to the next job and it is imperative that it move on schedule, even if overtime is required to complete the work, so as not to interfere with the advance schedule. With such an arrangement, the number of tie-tamping outfits, ballast cleaners, rail layers, or cranes, that are on a division may vary considerably from year to year, or even in the same year, while units like spreaders, concrete mixers, or compressors will be on several divisions in the course of a year. The transfer from one piece of work to another is usually made after the close of work on Saturday, so that the machine may reach its new location for work Monday morning, thus minimizing the actual working time lost in transit.

The frequent movement of machines between divisions necessitates an accurate record of the location of each machine at all time to insure compliance with the schedule and to provide for emergencies that may occur. The record is kept in the general office by means of a card index and a calendar that show the dates each machine is to move in accordance with its schedule.

As the end of a schedule nears, the machine is given a thorough inspection by a qualified mechanic, assisted by the operator, to determine if its condition is such as to permit it to continue in service or whether repairs should be made before going on the next assignment. If parts are needed, they are ordered in advance and the machine is shopped and repairs made with no time lost waiting for parts.

Units like mole ballast cleaners, tie-tamping outfits (including tamping guns), hose and connections, and machines whose work cannot be done in the

winter, are all given a general cleaning, overhauling, and painting at the end of the season at a central shop, so that when sent out in the spring they are in first-class working condition, and usually go through the next working season without serious breakdown. The tie-tamping compressors are used to some extent in the winter season for bridge work, hillside trimming and other work requiring air, but the compressors on this work are so programmed that all are given the necessary overhauling before the beginning of the spring work. Also, during the winter season, repairs are made to cranes and ditchers that need overhauling, a program as to shopping being prepared so that a sufficient number will be on hand to take care of the winter needs, but so arranged that all will be in good working condition in the spring.

Assign Regular Operators

Regular operators are assigned to major machines such as cranes, ballast cleaners, compressors, spreaders, trucks, sweepers, and the like. The operators are instructed by qualified mechanics and by the service men of the manufacturers as to the proper methods in the care of the machines. Many have received training in the manufacturers' plants and at the maintenance of way equipment shops. The operators are qualified to make the minor repairs and are required to inspect the machines constantly, making the minor adjustments and repairs as permitted without interfering with the progress of the work. They are provided with lubricating charts and instructions furnished with the machine, and keep a record as to the work they do. In the event of serious trouble, the division maintainer is called, who makes the repairs, assisted by the operator, or if necessary calls mechanics from the shops or manufacturers' service men.

The repair parts that are needed for field repairs are ordered by telephone from the central storehouse where but few parts are carried, since the storehouse is located close to several manufacturers' plants or warehouses, and the parts can generally be obtained quickly and easily and forwarded to the location of the machines by passenger train. This arrangement, put in effect through the co-operation of the stores and purchasing departments, has resulted in considerable economy in permitting a small stock of parts to be carried without interference with a quick and dependable service in obtaining parts when needed in the field.

Breakdowns Are Costly

However, no matter how good or efficient a system may be devised for obtaining parts and making field repairs, breakdowns in service with the resulting delays severely penalize the progress of the work, disorganize the forces and disrupt a well-planned schedule. This is reflected in the cost. To secure continuous operation by reducing breakdowns to a minimum is a problem of first importance, and it is being solved gradually by the manufacturers through the design and construction of rugged and dependable machines that will withstand the most severe uses and abuses to which a roadway machine is subjected. Breakdowns in service are also being diminished by the thorough overhauling between seasons and systematic assignment as previously described.

Periodic monthly inspections are made by the division equipment maintainer to insure that the operators understand their machines thoroughly, are taking proper care of them, and are following instructions as to lubrication and adjustments. These inspections are made also to determine whether the machines are working properly, what repairs are likely to be needed and how soon they should be made. Occasionally an inspection is made by regional officers, who check the work of the division maintainer and the efficiency with which the work is being performed.

The manufacturers of most machines usually have all machines of their make thoroughly inspected at least once a year by service men, who also instruct the operators and division maintainers as to the proper methods of maintenance and operation, and who make reports on the condition of the machinery inspected. This service has proved valuable in bettering the performance of mechanical equipment.

Daily reports are made by operators assigned to special machines as to the amount of work done, the character of the work, its location, delays and the reason for them, the number of men engaged, and the amount of fuel and oil used. These reports are sent to the division, general division, regional and system officers, where they are checked to determine whether each machine is being worked to capacity and the desired performance obtained. If the results are not satisfactory, inspections and investigations are made in the field to determine why the performance is not up to the expectations and to make such corrections in operation as may be necessary to insure the desired output.

Daily Reports Are Tabulated

The daily reports are tabulated and monthly reports are prepared showing performance of machines by divisions, and these are studied to determine what corrective measures are needed for specific outfits. Yearly reports are prepared, from which an analysis may be made as to the average cost, what methods are economical, what policies should be put into effect to increase the efficiency, what additional machines should be acquired, and how they should be distributed to maintain and improve the tracks and property to the standard required for a continued and increasingly successful performance.

In order to benefit the most from the outlay for equipment which, owing to the character of work, cannot be operated in the winter, it is essential that such equipment be worked as many days and as many hours as possible to achieve an economical output. The tie-tampers, mole ballast cleaning machines, spreaders on ditching work and the like, start as early in the spring and work as late in the fall as weather and track conditions permit. The organization required for the operation of each unit becomes more proficient the longer it is held together; consequently, a long working season develops a better trained organization and results in a greater amount of work done at a lower cost. Moreover, advantage is taken of the long days between May 15 and August 15 to increase the working time of the crews engaged in the operation of the various machines. Double tricking was tried, but was not satisfactory, because with two operators on one machine each would leave adjustments and repairs to the other, with the result that they were not made and costly breakdowns were frequent, and instead of increasing production it was retarded at an increased cost. It was found that the best results were obtained by working one operator and one crew with each unit 10 hours. A longer

day tired the gang to such an extent as to decrease its efficiency the following day.

Equipment Can Be Made Popular

Power machines for maintenance of way work, selected so that the amount of work performed will be increased with less effort on the part of the worker, are accepted and used enthusiastically by the men, most of whom, owing to a natural human tendency, prefer to handle a tamping gun rather than a tamping pick, or to drive a tractor that pulls a mowing machine or sweeps snow from the sidewalk to swinging a scythe or shoveling the snow, or to ride at ease on a motor car to pumping a hand car. Devices that are practical and which will permit doing the work with less effort, will be used even if it is necessary to revise established practices of handling the work. Machines or appliances that are not economical or fully developed, but cumbersome and awkward to handle will be rejected. However, machines that are right in principle and for which there is a need should be developed and improved by extensive trials and tests so that when presented for regular use they have been perfected so as to be acceptable to the users.

New uses are continually being revealed for mechanical equipment that permit a wider use with less idle time. The tie-tamping compressors are used between seasons to a large extent for bridge work and hillside trimming, and demands for them require a careful program to insure the essential annual overhauling. Snow sweepers for cleaning snow from sidewalks and platforms are used, when there is no snow, to sweep team and freight-house yards. Snow flangers are used for ballast spreading. Air compressors from paint-spraying outfits are used to furnish air for snow-melting appliances. Chucks have been applied to power rail drills for running up bolts in laying rail. Motor cars, auto trucks, crawler cranes and track cranes have been found adaptable for many uses that were not anticipated when the equipment was acquired.

Power machines have demonstrated their value in maintenance of way work, in that more and better work is being performed as reflected in the improved riding qualities of track and a neater appearance of right-of-way. The results obtained warrant a still more extensive use of mechanical equipment to meet the ever-present demand for greater economies and a higher efficiency in the betterment of an already good performance.

Accident Ascribed to Poor Track

THE derailment of a freight train, on a branch line of the Pere Marquette on January 16, has been ascribed to poor track, according to a report issued by the Bureau of Safety of the Interstate Commerce Commission. The accident occurred near Fenwick, Mich., on a branch line extending from Stanton to Haynor. This line, which carries only a negligible traffic—ordinarily one extra freight train per week—is of light construction. The track is laid with 56-lb. rail, 30 ft. in length, with an average of 18 softwood ties to the panel on tangent track and is ballasted with sand. No tie plates or rail anchors are used.

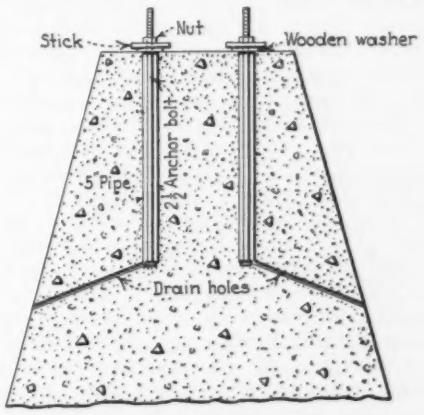
The train involved in the accident was a freight train hauled backward by a Consolidation type engine, weighing 163,000 lb. The tender and subsequently the engine were derailed on tangent track while moving at a speed estimated at approximately 15 miles per hour. The fireman and head brakeman were killed.

Testimony offered by the section foreman and track supervisor developed no pertinent facts, except that the track supervisor had made what he considered a thorough inspection of the track in November, by passing over on it on a motor car, and that his last trip over this subdivision was made in December, riding in a caboose. The conclusions reached in the report of the bureau were in part as follows:

"An inspection of the track for a considerable distance northward, or beyond where repairs had been made [after the accident], disclosed that the track was very poorly maintained; the ties were badly railcut, the east rail was as much as two inches low at a point less than 100 ft. from the first mark of derailment; the gage varied from one-fourth inch narrow to one inch wide; the rails were badly worn and kinked, and in some cases the spikes were so far away from the base of the rail as to permit them to move laterally, or to one side, under a passing train. It is believed that these conditions caused the tender to sway and rock to such an extent that one wheel of the tender mounted the west rail, where it rode for a short distance, then was raised in the air again, and then dropped off on the inside of the rail and continued on the ties until the final derailment occurred."

Protecting Anchor-Bolt Holes from Freezing

THE enclosing of anchor bolts in the pedestals for steel viaduct columns in pipes of sufficient diameter to allow the necessary adjustment of position during erection is a common practice. But in latitudes subject to severe winters, this practice has been a source of trouble by reason of the freezing of water



How the Bolt Holes Are Protected

entering these pipes before the steelwork has been erected and the annular space between the anchor bolt and the pipe has been closed by a cement grout filling.

Cracking of concrete pedestals from this cause has led the Canadian National, Western lines to provide simple preventive measures. A small drain hole, placed at a considerable pitch, is provided at the base of the pipe surounding the anchor bolt so that any water reaching the pipe can readily run away. How-

ever, dependence is not placed entirely on these drains, since the freezing of the dripping water may cause the drains to be closed. The anchor bolts are, therefore, provided with a tight-fitting wooden washer of sufficient size to cover the end of the pipe. This is slipped down over the bolt and held down securely on the top of the pedestal by wedging a stick of wood under the nut on the end of the bolt.

We are indebted for this information to W. Walkden, bridge engineer, Canadian National, Western region.

The Foreman's Duty As An Inspector

A. C. TODD, section foreman on the Kansas City Southern at DeQueen, Ark., discussed the duties of a track foreman in inspecting track to insure its safety, at a meeting of the Kansas City Southern Maintenance of Way Association at Shreveport, La. His paper as well as comments made on it by W. G. Morgan, division engineer, were so much to the point that we present them in abstract:

Abstract of Mr. Todd's Paper

The inspection of track is the most important duty of a track foreman; by inspection, I mean to observe closely the line and surface of the track; to look closely for rails showing any defects; to examine rail joints for broken angle bars and loose bolts; and to use the gage frequently, especially on curves and around switches. In no case should a foreman fail to examine his switches most carefully. He should see that the points fit up well; that the guard rails are tight and at proper gage; that the rods and switch stand are in good condition; and that all bolts are in place and tight. The slide plate braces should be inspected to see that they fit snugly against the rail. The gage and level board should be used frequently in examining switches.

Bad weather makes it even more important that the foremen make frequent inspections in order to discover the imperfections in the track and the roadbed, and to correct such conditions, when found, as it is a proved fact that soft, squeezy places get rough quicker during wet weather and cannot be permitted to run without attention as long as during the dry summer months. This applies as well to the rail and rail joints during cold weather. The section forces should go over their sections every two or three days, looking for broken or cracked angle bars, and defective rails and joints where the rail has contracted to such an extent as to break the bolts and cause an open joint.

In handling program work, work from one end of the section one day and from the opposite end the next. In this way practically the entire section can be seen by the foreman every second day, and when any condition is observed that needs attention, he can stop and correct it before engaging in program work. I do not think a foreman should ever become so absorbed in program or other work requiring several days as to neglect his track inspection, but he should be satisfied that everything is in safe condition before continuing from day to day on the program work.

Almost every foreman, in going over his section, has at some time, found an unsafe condition that needed his attention before another train passed over the track. I do not want to convey the impression that we should be traveling over our sections all of the time, but I do feel that we should see our sections often enough to know that there is nothing wrong (the frequency of the trips depending principally on the weather and other climatic conditions), and should go over them at least each Wednesday and Saturday, the days we usually spend in smoothing up track, inspecting switches and other inspection work, to observe imperfections. Remember at all times, that the safe riding condition of our tracks has precedence over all other responsibilities.

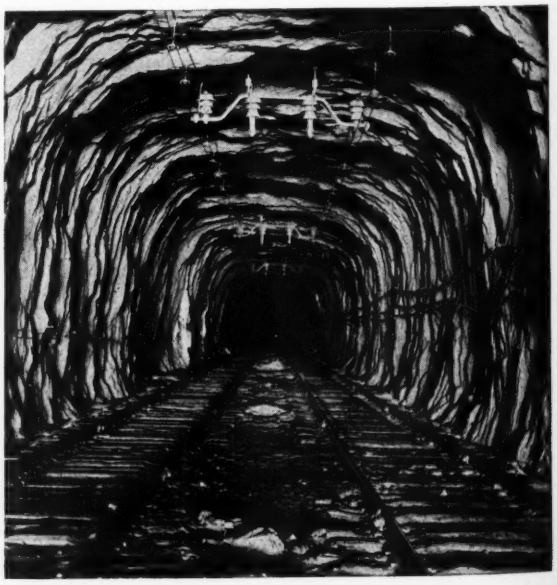
Excerpt from Mr. Morgan's Remarks

I think all of our foremen appreciate how fast our trains run. If you could make a trip of 50 or 100 miles every so often on an engine you would realize how it feels for an engineman to run 60 miles an hour over your tracks. When you do that, you wonder if everything is all right.

One time when I was a roadmaster, I was making a motor car trip over a certain section and came up to a pair of broken angle bars. I could see the end of the rail sticking up while I was still 600 or 700 ft. away. After I had looked at the joint I proceeded until I found the foreman putting in ties. He had not been over the track in four days, and the indications were that the bars had been broken at least two days. A foreman should not become so busily engaged in program work that he fails to take time to go over his section and see that it is all right.

Lots of things can happen in a short time. During my experience on the railroad I found two very bad broken rails. I was on a passenger train once and after we experienced a bad bump I got off, hurried back and found a foot of rail out on a curve. I reached there just in time to stop a fast freight train. The section foreman was working within one thousand feet of that point. I found another rail broken lengthwise 30 min. before a passenger train was due, and this rail had been broken for some little time.

If I were a foreman I would want to see my track every second day in order to know that everything was all right. His first duty is to see that the main line is safe for operation. If he does that, he will often find conditions that he knows in his own mind will become unsafe in a short time.



A Daylight Photograph of the Hoosac Tunnel

A statement of experiences and results in protecting wood against decay

Creosoted pine ties in a material yard on the Illinois Central's Edgewood line

Illinois Central Shows Value of Timber Treatment*

By A. F. BLAESS
Chief Engineer, Illinois Central System

THE Illinois Central began the treatment of timber in 1903 and since that time has treated 52,009,662 crossties, 166,004,239 ft. b.m. of lumber, 27,565,763 ft. b.m. of switch ties, and 12,970,450 lin. ft. of piling. Included in these figures is material used for bridges and buildings, trunking, platforms, telegraph poles, crossing plank, fence posts, and water tanks. During the last year we have also used creosoted material in the decks of some stock cars.

Treated ties were first used on the Illinois Central System in 1891 when 520 red oak ties treated with zinc chloride were placed in track near Jackson, Tenn. Of these ties, 223 were taken out in 1900; the balance were removed in 1901. In the following year, 670 treated ties were laid on the Illinois division. Fifteen hundred treated ties were applied at various points on lines south of the Ohio river in 1893, the life of which varied from four to eight years.

Began General Use in 1903

It was in 1903 that treated timber came into general use on the Illinois Central, when treating plants were constructed at Grenada, Miss., and Carbondale, Ill. These plants were constructed by the Ayer & Lord Tie Company of Chicago, through whom a very large proportion of our ties have been secured and who have treated the greater part of the ties and timber used on the Illinois Central. The total number of treated ties applied in main tracks during 1903 was 23,364. These consisted principally of red oak, with some beech, gum and chestnut ties, treated with ½ lb. of dry soluble zinc chloride in solution per cubic foot of timber. In 1927, we treated 2,510,899 ties, or more than 100 times as many as were treated in 1903.

Chloride of zinc was employed exclusively for the treatment of ties until 1907, when we began the use of creosote oil in addition to zinc chloride. Since that year the percentage of ties treated with oil has showed a gradual increase while the number treated with chloride of zinc has showed a corresponding decrease, except for two years during the war when we could not secure sufficient creosote oil to meet all of our requirements and the more extensive use of zinc chloride was necessary.

Ties treated by the zinc-chloride process gave fairly good service on our lines north of the Ohio river and west of Chicago, but were not very successful south of the Ohio river, owing to the difference in climatic conditions. As a result we confined their use, as far as practical, to our northern and

*Abstracted from a paper presented before the annual convention of the American Wood Preservers' Association at Louisville, Ky., on January 23.

western lines, while the use of ties treated with creosote oil was confined largely to our southern lines.

We soon found that ties newly treated by the zinc-chloride process were of such greatly increased electrical conductivity that for some time they caused trouble with the track circuits of our signal system. Ties treated by this process also frequently checked badly. These troubles were somewhat reduced by piling the ties close together while seasoning, before and after treatment, to prevent rapid drying out, and holding them several weeks after treatment before applying them to the track.

Now Use Creosote Exclusively

As the supply of suitable tie timber became more scarce and the prices increased, we have progressively increased the number of ties treated with creosote oil (which has proved very successful) from year to year and decreased the number of ties treated with zinc chloride. Our experience has convinced us that the creosote treatment is better adapted to climatic conditions on our lines, and the use of zinc chloride was entirely discontinued in 1921.

During and immediately following the war, we were unable to secure a sufficient number of ties to take care of our requirements in the territory from which we ordinarily drew our supply and to offset this we used a large number of untreated fir ties from the Pacific Coast. We have, in the past, also used a large number of untreated white oak ties on our lines in Kentucky and Tennessee and north of the Ohio river. We have found in recent years, however, as the oak timber supply has been growing more scarce, that the white oak ties secured contain a great deal more sap, are coarser grained and are more porous than in former years. This has resulted in shortening the service life of these ties to such an extent that we were justified in treating them, and in 1926 we inaugurated the practice of treating all ties, with the exception of Louisiana heart red cypress, which has been used for both switch ties and cross ties for many years. Louisiana red cypress timber for tie production is growing scarce, and the limited number of ties of that kind secured by us have been used in the vicinity of New Orleans where they were produced.

Approximately 78 per cent of all ties in our main-line tracks are now treated; 95 per cent of all ties applied in 1927 were treated with creosote oil.

Marked Reduction in Tie Renewals

Tie renewals in 1901 amounted to 324 per mile of maintained track, as compared to 188 per mile in 1927. The renewal of 188 ties per mile in the latter year included the Yazoo & Mississippi Valley lines, on which renewals amounted to 254 per mile of maintained track in 1927. This high figure on the Y. & M. V. was due largely to the damage from the Mississippi flood, which put nearly 600 miles of this line out of service and practically destroyed 300 miles. Tie renewals were also exceptionally heavy on the Gulf & Ship Island, recently acquired by the Illinois Central, averaging 355 ties per mile in 1927. Excluding the Yazoo & Mississippi Valley and the Gulf & Ship Island, the tie renewals per mile of maintained track on the Illinois Central alone were 161 for 1927. The complete figures for 1928 are not available, but will undoubtedly show still further reduction.

Now that we are using treated ties exclusively on our properties, with the exception of a limited number of Louisiana heart red cypress ties in the vicinity of New Orleans, which should give us approximately the same life as treated ties, and are protecting all ties applied in tracks where the density of traffic and use is such that the life of the tie is determined by mechanical wear rather than decay, with tie plates of proper design, we expect to show a substantial reduction in the number of tie renewals per mile per year in coming years.

We have established test tie sections at seven different points on our line, where there are large differences in climatic conditions, keeping an accurate record of the age, kind of wood, kind of treatment, and other pertinent data. These sections are inspected annually, all ties taken from track each year are examined and a record is made of the cause of removal. The results to date show a greatly increased life for creosoted ties, as compared with zinc-treated ties, also long service life for red cypress untreated ties in Louisiana. With few exceptions, the removal of creosote treated ties has been from causes other than decay, while few zinc ties were removed except because of decay, the same being true of the untreated ties.

Bridge Timber

The use of creosoted piling and bridge decks was begun in 1904. Our first creosoted bridge decks consisted of open-deck trestles protected by closing the openings between ties and placing a thin layer of ballast for protection against fire. This design did not prove satisfactory and was abandoned in 1905, since which time open-deck trestles have been constructed with treated piling, caps and bracing, the stringers, ties and guard rails being untreated, as it was the popular belief that a serious fire risk was incurred by constructing bridge decks of creosoted timber.

Reports presented to the American Railway Engineering Association and the American Railway Bridge and Building Association indicate that creosoted timber does not offer any greater fire hazard than untreated timber in railroad trestles, except with freshly treated timber. We are endeavoring to overcome this hazard by allowing the treated timber to season a sufficient time after treatment and before application to the structure to permit the more volatile surface oils to evaporate or become absorbed by the timber. We have recently revised our standards for open-deck timber bridges, the revised standard calling for the use of treated material throughout.

Our ballast-deck trestles are constructed entirely of treated timber, and with the adoption of an all-treated, open-deck trestle, the Illinois Central is using only treated material in the construction of its timber bridges.

On January 1, 1928, we had in service 140,166 ft. of open deck trestle with treated bents, piling and bracing, and untreated deck; 412,387 lin. ft. of ballast-deck trestle constructed throughout of treated material; and 4,371 ft. of open-deck trestle, all treated It is conservatively estimated that the use of treated timber in bridges has much more than doubled the life of such structures. We also figure the life for treated piling as at least double that of untreated piling, although our records show treated piling in place 25 years that are still in good shape, which would indicate that we can expect much more than twice the life of untreated piling.

The increasing scarcity of suitable timber for the

construction of water tanks has led a number of railroads to construct creosoted water tanks. The first creosoted railway water tank of which there is any authentic record was constructed by the Cleveland, Cincinnati, Chicago & St. Louis at Sidney, Ohio, in 1907. The staves and bottom plank, only, were creosoted, the sub-structure being steel; this tank is still in service.

Plans were prepared for the construction of creosoted tanks on the Illinois Central in 1913, but the first tank was constructed in 1917 as an emergency measure, owing to the embargo placed on the use of steel for the construction of water tanks by the priority board. The Illinois Central standard creosoted tank includes the entire structure from foundation to finial, comprising tank, frame, frost box and roof. We have constructed creosoted frames for water tanks for more than 25 years and were in all probability the first to use them, as we were also the first to creosote the entire structure. The timber used in the construction of the tank is Southern yellow pine.

The Illinois Central's creosoted tanks are built in three standard sizes; 30,000 gal. capacity with 16-ft. staves and 18-ft. bottom plank; 50,000 gal. capacity with 16-ft. staves and 24-ft. bottom plank; and 100,000 gal. capacity with 20-ft. staves and 30-ft. bottom plank.

The first 18 or 20 tanks constructed were practically all sap wood, and the Rueping process was used in their treatment, five to six pounds of oil being retained per cubic foot of timber. On account of the difficulty encountered in getting all-sap timber, the specifications were modified in 1920 to permit some heart wood. The treatment was then changed to the full-cell process, using 15 to 16 lb. of oil per cubic foot, in order to get better penetration into the heart timber.

An important factor in the construction of these tanks and one that will undoubtedly increase their life is that all timber more than one inch in thickness is framed before treatment. The work of framing the tank is given such careful attention that it is rarely necessary even to bore a hole in the treated timber during the field erection.

In the last 13 years we have constructed a total of 104 creosoted tanks. It is estimated that the life of these tanks will be 40 years, as compared to a life of approximately 30 years for the best untreated timber available, and, according to our records, an average life for all untreated tanks of approximately 25 years.

A further advantage of the creosoted tank is that the maintenance is practically negligible. One objectionable feature of the creosoted tank is the tendency of the water to seep through the timber. This makes it necessary to apply a water-proofing compound to the interior of the tank after erection. Another lesser objection to the creosoted tank is its appearance, due to discoloration, after it has been in service for a number of years. These objections are, however, of a minor nature, and I have no hesitancy in stating that the creosoted tank has been successful in both efficiency and economy.

Framing Timber Before Treatment

The importance of framing bridge and other structural timber before treatment was recognized from the start as an important adjunct to the actual process of treatment, and the Illinois Central began the framing of timber before treatment at the time the treating plant was established at Grenada, where practically all bridge and structural timber is treated. While our framing operations do not include all timber treated, they do cover practically all timber used for construction and will be extended as conditions permit.

The necessity for machining crossties before treatment was realized as the treatment was extended and a machine for adzing, boring, trimming the ends and branding ties was installed at Grenada in the latter part of 1923. Hewed ties only are adzed, but both hewed and sawed ties are bored and sawed to length. The ties are also branded with the date. A second tie-working machine was installed at Carbondale in 1928.

While the protection of timber against decay is well under way when it leaves the treating plant, the job is by no means finished, as it is of almost equal importance to the actual treatment that it receive the proper care in its application, and it is essential that the process of treatment be followed by proper precautions, both in handling and in application. Much of the premature decay of treated timber can be traced directly to abuses in the field, not the least of which is in framing. Field framing is, of course, sometimes necessary, even with the most careful attention to the details of framing at the treating plant.

Our railroad is by no means free from abuses of treated timber, but we are putting forth every effort to overcome them. Existing instructions are that the exposure of any untreated surface, either by accident or abuse, or through framing after treatment, shall be followed by two applications of hot creosote oil. This applies particularly to piling at the time of cut off. We hope to accomplish the desired result by following up and enforcing these instructions vigorously.

More Attention to Wear

While great progress has been made in the preservation of timber so that we can now protect the tie against decay throughout and even beyond its mechanical life, much remains to be done to protect it against mechanical wear.

During my railroad experience, which has covered over 30 years, I have seen the weight of rail on the Illinois Central increased from 60 lb. to 110 lb., and rail fastenings grow from the old fish plate or flat iron strap with holes punched to correspond with the rail, to a heat-treated fastening of strength and section equal to that of the rail itself, and the old track bolt that could be twisted in two with a 24-in. wrench replaced by the heat-treated bolt that defies almost any leverage that can ordinarily be applied. Almost every part of the track structure, including ballast, has been increased to conform to the increase in power and traffic that it has had to sustain, the sole exception being the tie.

No substitute tie has been found to be entirely satisfactory and economical. Successful efforts toward increasing the mechanical life of the treated timber tie will not only result in further conservation of timber, but should tend to postpone the adoption of the substitute tie. It would appear that the solution of the problem rests with the betterment of the tie and improved methods of protecting it from wear. This is a joint responsibility of the tie producer and the engineer in charge of the maintenance of track.

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE AUGUST ISSUE

1. *What is the maximum number of jacks which can be used to advantage when making a light raise out of face with a gang of from six to eight men? How far apart should the jacks be placed?*

2. *What ingredients, proportions and consistency should be used for mortar for the pointing of old stone masonry? To what depth should the old mortar be raked out?*

3. *What are the relative merits of the U. S. standard rolled and cut threads and Harvey grip threads for track bolts? What are the relative merits of square and hexagonal nuts for track bolts?*

4. *What steps can be taken to avoid a slippery finish when laying concrete platforms?*

5. *To what extent can small self-propelled cranes be used to advantage mounted on cars in work train service? Should they be fixed on one car or move from car to car?*

6. *How can the corrosion of valves or other moving parts at the lower ends of water cranes be prevented?*

7. *What are the advantages and disadvantages of applying the extra spike to the inside of the rail when double spiking on curves where tie plates are used? In such cases, should both rails be double spiked?*

8. *When freshly creosoted timbers are placed in a bridge deck, what measures can be taken to reduce the fire hazard?*

Pavement Around Freight Houses

What are the comparative merits of the different types of pavement for use around freight houses?

Vitrified Brick Will Give Best Service

By F. RINGER

Chief Engineer, Missouri-Kansas-Texas, St. Louis, Mo.

Among the different types of paving commonly used around freight houses are brick, concrete, sheet asphalt and sometimes creosoted wood blocks.

Heavy vitrified vertical-fibre paving brick laid on a heavy concrete base and with joints filled with an asphalt filler, makes the most satisfactory pavement for permanent and general service. When properly laid, this provides a surface that requires little or no maintenance for long periods of extremely hard wear. The bricks withstand well the grinding action of steel-tired wheels and chains. They present a non-skid surface for rubber-tired vehicles and for horses. They provide a top surface that can be easily and quickly replaced without the necessity of relaying a new base. The resurfaced portions can be subjected to traffic immediately after laying, thereby keeping the driveways out of service for a minimum length of time.

Concrete slabs with a rough float surface afford a comparatively inexpensive pavement in places where temporary hard surfaces are required, and provide a desirable non-skid trucking surface. The disadvantage of this type of paving is that under continuous heavy wear the surface becomes worn and pitted and is not easily repaired. Badly worn surfaces may be refinished with a layer of sheet asphalt.

Asphalt pavements are common where the city streets are paved with such material. Such pavements are less expensive than good brick, and present a water-tight, clean surface which is easily warped to conform to any shape and is easily joined to almost any other kind of surface. Such pavements are desirable where it is necessary to tear up the street frequently for pipe lines or other improvements, as the asphalt top may be replaced without leaving a patched appearance. The objection to this type of pavement is that it irons out badly under heavy traffic in hot weather.

Wood block paving has the advantage of being quickly resurfaced and withstands extremely heavy wear, but it presents a slippery surface when wet, on which to do the necessary turning and twisting required in backing trucks squarely up to the docks. Also, the blocks are often displaced by storms or by buckling on account of expansion in protracted wet seasons.

Of the four different types, brick will generally give the greatest length of service, with the others in about the following order—wood block, asphalt and concrete.

Granite Block for Heavy Traffic

By F. E. MORROW

Chief Engineer, Chicago & Western Indiana, Chicago

Our experience with pavements around large freight houses, especially since wheel loadings have been increased so largely with the advent of the motor truck, has led us to adopt granite blocks on a heavy concrete base not less than eight inches thick, and thicker where conditions warrant. This type of pavement is also preferred for inclined approaches to freight houses or team tracks on account of providing a better footing for horse-drawn trucks.

At freight houses where the traffic is not so heavy, we use concrete pavement eight inches thick. We have used a number of the various types of pavement for this purpose in the past, but now use the two types mentioned almost exclusively when laying new pavement.

Cement or Lead Joints

What are the relative merits of lead and cement joints for water pipe lines, from the standpoint of maintenance?

Cement Economical in Certain Cases

By F. D. Yeaton

Assistant Engineer, Chicago, Milwaukee, St. Paul & Pacific, Chicago

Cement joints may require more maintenance if the pipe line is not laid under proper conditions. They should not be used in soil liable to settlement, as under a railway embankment or in marshy or swampy ground, since they are not as flexible as lead joints and are apt to fail from cracking if used in lines where settlement occurs. Trouble may also be experienced with such joints when laid under tracks or other places where the line is subjected to heavy vibrations. We have had trouble with cement joints near water columns caused by the surge from the quick-closing valves, the sudden increase of pressure blowing out the joints.

Municipalities have made extensive use of cement joints, but as a rule the railways prefer lead joints and have been slow to adopt the cement joint. One railway laid an eight-inch cast-iron discharge line, using cement for three-fourths of the joints and lead for every fourth joint to provide flexibility and expansion.

The first cost of cement joints is less than lead and under favorable conditions it may be economical to use them, even if the cost of maintenance is slightly higher.

Tamping Joint Ties

What bad effects, if any, result from tamping joint ties too solidly?

It Will Cause Rough Riding Track and Rail-Cut Joint Ties

By V. H. Shore

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kans.

There are several conditions under which joint ties can be tamped too solidly, the main one being in "spotting up" low joints where the raise does not exceed an inch on track ballasted with rock or with any kind of ballast which pulverizes easily. Where it is necessary to give joints a light raise with the latter kind of ballast, it is a tedious job to tamp them thoroughly unless the bed under the tie is loosened with the point of the pick or in some other way in advance of the tamping. This is not often done, but the ballast is forced under the tie with the tamper, pulverizing the ballast, which causes the joint to churn in wet weather.

Tamping joints too solidly in heavy ballast where a light raise is being made will cause rough-riding track and will also cause the joint ties to become rail cut. Any ties in a rail that are tamped more solidly than the others will cause bad-riding track, hence they should be tamped uniformly from the ends to a point a foot inside the rails. The centers should not be tamped hard, but should be filled underneath by blading the ballast with a shovel or similar tool.

None, if Other Ties Are Tamped in Proportion

By E. D. Swift

Engineer Maintenance of Way, Belt Railway of Chicago

I have never seen joint ties which I thought were tamped too solidly, but I have seen where the other ties were not tamped as solidly as they should have been, with the result that the riding qualities of the track were as bad as if the joints had been low. In order to secure the best results, the tamping should be done so that any settlement of the track will be uniform. To do this, it is necessary to tamp the joint ties more solidly than the ties under the remainder of the rail, since the joints are subject to greater impact on account of the joint gap and also sometimes because of a slight difference in the heights of the abutting rail ends. The proper amount of tamping as between the joint ties and other ties is usually something of a "cut and try" proposition, but is one that can be mastered after a few trials.

Controlling Speed of Motor Cars

What is the best method of insuring observance of restrictions on the speed of motor cars?

Supervision and Education Are Necessary

By G. M. O'Rourke

District Engineer, Illinois Central, Waterloo, Iowa

The methods used by a supervisor I know produce satisfactory results. This supervisor accompanies a gang over the section on the car, which he operates himself in a manner to comply with all the rules. He runs at a speed not to exceed 15 mi. per hr., slows down for switches, road crossings and interlocking plants and send a flagman ahead around curves where the view is obscured. At the end of the section, he discusses with the foreman and his men the example he has set for them and gets their assurance that they will do as he has done in running the car. At frequent intervals thereafter he makes surprise tests to satisfy himself that the rules are being observed. The results he has obtained in reducing motor car accidents on his district prove the value of his methods.

The Cars Should be Geared for Maximum Allowable Speed

By V. H. Shore

Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

The surest method of enforcing the observation of restrictions of speed of motor cars is to have them rated so that the maximum allowable speed cannot be exceeded. It is necessary to have cars with power enough to haul the gang and its tools, together with a trailer and a limited number of ties, but it is not necessary to have the car rated up to 35 or 40 miles an hour to do this, as the low-geared car is the more powerful. If the speed restrictions for section, extra or bridge gangs are from 15 to 20 miles an hour, the car should be geared to be capable of speeds only slightly in excess of this. Of course, the car must be brought under control at public highways, through towns, over turnouts and at other places where, in

the foreman's judgment, the maximum allowable speed would be unsafe, but the low-geared car would prevent many accidents caused by fast running.

Discipline Must Be Used When Co-operation Fails

By W. L. Roller
Engineer Maintenance of Way, Hocking Valley, Columbus, Ohio

This is a problem in which we are vitally interested, but one in which it is hard to arrive at a constructive conclusion. The speed stipulated in our book of rules is 20 miles an hour, which, in my opinion, is entirely too restrictive to enlist the full co-operation of our operators and we are contemplating increasing this speed to 25 miles an hour as a measure to secure the co-operation of all in the observance of the rules. We feel, however, in case the speed restriction is violated, that the only way to guarantee strict observance is to apply severe discipline, and we have already established a precedent in some cases.

Resawing Released Bridge Timbers

To what extent can ties and other timbers released from bridges be resawed economically for other uses?

Sound Portions Can Be Resawed Economically

By O. A. Shultz
Inspector of Stores, Chicago, Burlington & Quincy, Chicago

The Chicago, Burlington & Quincy operates two resaw mills, one at Galesburg, Ill., and the other at Havelock, Neb., to which is sent all timber released from bridges as well as from buildings, torn-down cars and other sources, unless it is in such condition that no usable material can be obtained from it.

When bridge ties are received at these plants, they are sorted into two grades: one that can be resawed to good advantage, while the other covers the ties that are so badly worn or injured that they are fit only for blocking or cribbing. These latter are stored where they can be loaded quickly for use in emergencies, such as washouts or fires, or for such other purposes as may be necessary.

In resawing ties, it is usually found that the top two inches must be removed on account of rail cutting, or the sinking of the tie plates into the wood. The ties are then sawed into such dimensions as may be needed, care being taken to obtain the larger sizes as far as possible to reduce the cost of sawing. Since bridge ties usually range in cross-section from 6 in. by 8 in. to 8 in. by 10 in. the usual sizes obtained from them are 4 in. by 6 in., 4 in. by 8 in. or 6 in. by 6 in. The two-inch planks sawed from the tops of the ties, if sound except for the rail or tie-plate cutting, are furnished for use in temporary platforms or as wall plates for temporary buildings, and their utilization for this purpose effects quite a saving.

With stringers, it is usually necessary to cut off 12 in. at each end to get back into the sound wood, and also to cut off the top two inches, since the upper surface is usually somewhat soft and uneven. As the standard stringer is 8 in. by 16 in.-14 ft. long, this leaves a stick 6 in. by 14 in.-12 ft. long, which, as in the case of the ties, is cut to the best advantage, taking into account the sizes needed and the cost of sawing. In this connection, the selection of a foreman of a resaw mill is an important matter, since his judgment in resawing material to the best advantage will make quite a difference in the economies which may be obtained by the operation of the plant.

The resawed material is used for various purposes according to its condition and probable remaining life. Much of it is used in repairs to stock yards and also as braces for wooden fences and snow fences, preferably on existing structures, so that when it becomes necessary to renew them "out of face" there will be a smaller loss than if new materials were used.

When pile trestles are renewed or are replaced with permanent bridges or openings, those portions of the piles from a point a little above the ground line to near the top are quite often sound and these also are sent to the mill, where they are sawed to the proper length and sent to the treating plant to be treated, after which they are used as supports for freight platforms or for small buildings, such as station or tool houses. This is the only kind of material which is treated after leaving the resaw, except in special cases. Thus, we have treated timber which was to be used as a bulkhead to retain a slide, since the material was to be exposed to conditions where the decay of untreated material would be rapid.

No attempt is made to saw one-inch lumber, and in only a few cases has two-inch lumber been sawed. At one time, when we had a large supply of bridge ties on hand, we sawed considerable two-inch material for stockyard fences, for which there was a demand, but as a rule we find it more economical to confine the smallest size to 4 in. by 6 in. Since our supply of this material is almost always smaller than we could use to advantage, we are able to select the sizes that give us the best operating results.

In working this material, saws with removable teeth are used, since, from the nature of the work, broken-off spikes are sometimes encountered which are not visible on the surface. In such cases, the damage done is small since it is a small matter to remove the injured teeth and replace them with good ones.

Much Usable Material Can Be Salvaged

By C. A. Lichty
Inspector, Chicago & North Western, Chicago

Ties on bridges receive the hardest wear of any timber in the structure and they are also subject to the most severe weather conditions. For these reasons, together with the injuries from spiking, they are of little value after removal except for blocking or cribbing, or to be cut up into engine wood for firing up locomotives. Most of the other timbers can be resawed to good advantage at some central location where the quantity of material warrants the operation of a small plant, even if the plant is operated only at intervals when material is scarce.

Stringers in wooden bridges are necessarily of the best quality of material, and as they are the least mutilated of any part of the structure they can be resawed to the best advantage and with the least waste. In the case of untreated material it can be put to many uses, even for finishing material for the interior of buildings. Odd lengths and uneven sizes can be used in the building of small structures, and especially for forms for concrete work. Cedar pile heads can be sawed economically into shingles, and those of hardwood into car stakes, engineers' ballast and grade stakes, jack handles, etc. The poorer classes of lumber from the resaw can go into storage platforms, board and plank walks, as well as into the great variety of temporary structures.

The best outfit for the average plant consists of the "pony" type saw frame with movable carriage, variable friction feed, and a 40-in. circular saw with inserted teeth; occasionally a boat spike or drift bolt, broken off and hidden in the timbers, will be encountered when, if the teeth are too badly damaged, they may be replaced readily, with a new set at small cost without removal from the arbor, when the saw is as good as ever. A 22-in. cross-cut cut-off saw mounted on a table, and a second-hand planer will complete the outfit for a small economical plant which can be housed under one roof, the material for which can all, except for the roof covering, be cut from second-hand bridge timbers, even to the trusses in the roof.

A plant of this type comes in very handy for resawing new material left over from the construction of engine houses, docks, coal sheds and other buildings where odd sizes accumulate which cannot be used to advantage unless made over into standard sizes. The best part of bridge ties and all shapes and sizes of blocking and waste ends can be cut into paving blocks for use in enginehouses, machine shops, paint shops and other buildings. This is one class of material that can be made use of from treated timbers.

Many roads have supplanted timber structures with steel and concrete to such an extent that, in many cases, the construction of a resaw plant would not be justifiable, and this must be taken into consideration, because a reasonable amount of material must accumulate to render economical operation.

Flange Oilers on Curves

What factors determine the economy of oiling rails to reduce curve wear? What is the minimum degree of curve and amount of traffic for which oiling is warranted?

Saving of Rails Principal Factor

By C. G. Delo

Chief Engineer, Chicago Great Western, Chicago

The Chicago Great Western installed two sets of automatic flange oilers (one oiler on each rail at two locations) in 1928 on what is known as Farley hill, between Dubuque, Iowa, and Farley, where the line ascends from the Mississippi river to the higher ground beyond the bluffs. In 19 miles of this location the track is mostly on curves, ranging up to a maximum of six degrees, and the grade approximates one per cent for a distance of about five miles. On this section of track, it is necessary to use a helper locomotive for ascending trains and flange wear of the rail has been rapid, necessitating the replacement of from 250 tons to 360 tons annually on this account.

One set of oilers was installed near the foot of the hill at the beginning of the heavy curve territory and the other set was placed five miles up the hill. Contours of the rails were taken on the various curves at the time of installation and again at the same points after the oilers had been in operation for 15 months, when it was found that the flange wear had been barely perceptible in that time for a distance of about two miles from the oilers, but had increased gradually beyond that distance. As a result of this test, it is now the intention to install additional oilers to bring the total number of sets to nine, averaging a little over two miles between sets.

From the data secured by the original installation, it is conservatively estimated that there will be an annual saving of 180 tons in rail renewals, on account of the decreased flange wear, after the additional oilers are in operation. There is also a marked decrease in the train resistance on the oiled track. While it will not be practicable to increase the tonnage of ascending trains, since they are made up to be hauled by one engine over the rest of the engine district beyond the top of the hill, it will be possible to increase the speed on the hill, so that a better balanced superelevation can be used and this will also be a help, in reducing both the flange wear on the high rail and the flattening of the low rail.

As to the minimum degree of curvature and tonnage warranting the use of oilers, we are not confronted with this question as yet and have no information on which to base an opinion.

Handling Quicksand

What is the best method of handling quicksand encountered in the excavation of open coffer-dams?

Depends on the Nature of the Work

By F. H. Cramer

Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago

We once had to install an open coffer-dam where a bed of quicksand about 8 ft. thick underlaid earth and clay about 14 ft. deep. In this case, we drove steel sheet piles as far as possible into the quicksand, and then excavated down to the quicksand, after which an inner coffer-dam of wooden sheet piles was driven through the quicksand, the dimensions of the steel coffer-dam having been made large enough to permit this.

We seldom strike quicksand in our excavations and when it occurs it has usually been where the plans called for foundation piles. In such cases, it is our practice to excavate as far as possible and then drive the foundation piles through the quicksand into the underlying clay, using a jet to facilitate the driving. After the piles are driven they are cut off and the water allowed to rise in the coffer-dam, and the bottom is then sealed by depositing concrete under water around the piles. After the sealing course has set, the water is pumped out and the construction of the pier carried on. In driving the piles, the level of the quicksand is raised by the displacement caused by the piles and it is necessary to provide pumps which will carry this out of the coffer-dam with the water.

Depends on Whether or Not Its Presence Is Known in Advance

By Bridge Engineer

If the presence and extent of quicksand is known, as it should be from the results of soundings, the methods of handling it can be determined in advance by adapting the installation of the coffer-dam to meet the conditions. The greatest trouble is experienced when its presence is not disclosed until after the excavation has been started, and this occurs sometimes even when soundings have been made.

The writer once had an annoying experience with quicksand on bridge work on a new line, where soundings had been taken which showed remarkably close results at all of the piers except the one in question, which was the last of six. The excavation was carried to rock at depths varying from 20 to 40 ft. at the different piers, this variation being caused by the profile of the stream crossing, since the surface

of the rock, although quite irregular, was at approximately the same general elevation. Steel sheet piles, 35 ft. long, were driven for the coffer-dams and at the last pier, which was located on the bank of the stream, it was necessary to excavate the surface to a depth of about eight feet so that the piles could be driven to rock. When the first pile "hung up" at the proper elevation, as shown by the soundings, the other piles were driven and they, too, stopped on what was supposed to be solid rock.

When the excavation was completed to the bottom of the sheet piles, it was found that they had stopped on a deposit of quicksand about five feet thick overlying the rock under a blanket of stiff clay. In this case, the excavation of the quicksand was carried the remainder of the distance by bracing a wale around the inner side of the sheet piles near their lower end and another one about five feet above it, leaving room between the sheet piles and the wale for three-inch wooden sheeting which was worked down to rock by means of mauls, there being no convenient way of using a power driver. Excavating was done by an orange-peel bucket hung from a derrick and as the surface of the quicksand was lowered battens were fastened over the joints between the wooden sheeting and another wale was placed along the sheeting to keep it from being crowded in by the pressure of the quicksand. While the work of driving the wooden sheeting was slow, as much care was taken to have the adjoining pieces fit closely, it was carried out successfully.

When to Remove Stringers on Filling Trestles

What is the best time of year for removing stringers from filled trestles? What reasons lead to this conclusion?

Best Time Is Between May 1 and November 1

By W. H. VANCE
Acting Engineer Maintenance of Way, Missouri Pacific, St. Louis, Mo.

It has been my observation and experience that the best time of year for removing stringers from filled trestles is between May 1 and November 1, for the following reasons:

1. At this season there is no freezing and thawing of the earthwork.
2. The period of heavy rainfall is usually over, thereby avoiding softness of the new roadbed under traffic.
3. The roadbed dries out more rapidly after rains.
4. When the work is done at this time it insures sufficient time for the embankment to settle and season in advance of winter or rainy weather.
5. For the foregoing reasons, money is saved in the cost of keeping the track in surface and in affording safety at higher speeds of trains during the seasoning of the new embankment.

Should Be Removed When Trestle Is Filled

By F. T. BECKETT
District Engineer Maintenance of Way, Chicago, Rock Island & Pacific, El Reno, Okla.

In Missouri, Kansas, Arkansas, Oklahoma, Louisiana, Texas and New Mexico, the stringers should be removed at the time the trestle is filled. The practice some years ago was to fill the trestle by any of the various methods then in use, and to place a slow order on the bridge during the time of filling as well as for a period of six months or more to allow the embankment to settle. After the stringers were removed, the slow order was continued until the roadmaster felt that the track was all right.

For the last several years, in the territory mentioned, it has been the practice to complete the job while the filling is in progress, thus making it necessary to maintain slow orders for only a comparatively short time and also effecting a considerable saving in expense by not having to send the bridge gang back to shim and reline the bridge. In this way the filling is completed while the work equipment is at the site, which is not usual when the material is allowed to settle before the stringers are removed.

Whitewashing Cattle Guards

A further answer to the following question discussed in the April issue.

What are the advantages of whitewashing cattle guards and wing fences? What are the relative merits of doing this work periodically by a small special gang moving over the road on a motor car and by the section gangs?

Each Method Has Certain Advantages

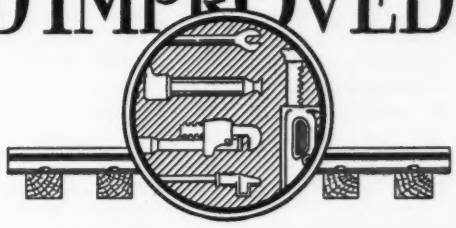
By A. C. BRADLEY
District Engineer Maintenance of Way, Chicago, Rock Island & Pacific, Des Moines, Iowa

The practice on the First district of the Rock Island is to whitewash the wing fences and stock yards twice a year, the roadmaster assigning a certain period for his section gangs to take up the work and carry it to completion. This plan is sometimes varied slightly, depending on local conditions, but has been found, in general, to be the most satisfactory practice. We are experimenting with the use of small special gangs for the work, and there are advantages in both methods.

When the work is done by the section gangs it is completed in a reasonable short time and in line with the systematizing of work. In the case of the small gang, there is a saving in the number of brushes used and required in stock and also from the fact that as the men become experienced they can do it more economically; on the other hand, the assigned territory is not cleaned up at one time. The principal reasons for whitewashing are to provide a neat appearance and to give a better indication of the location of the crossing.

Where the Erie Crosses a Fork of the Delaware River

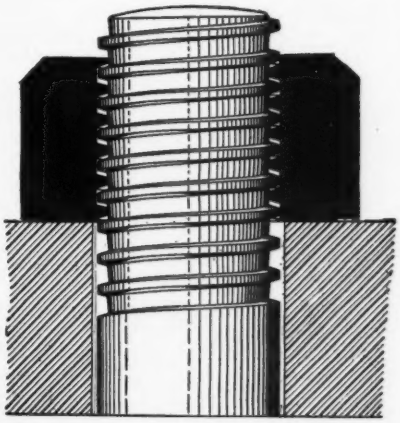
New And Improved Devices



A New Self-Gripping Thread

A NEW TYPE of self-gripping or self-locking thread is being introduced in this country by the Dardelet Threadlock Corporation, New York City, which is being applied to track bolts manufactured under license by the Bethlehem Steel Company. With this new thread, the nut can be locked on the bolt at any point, and, it is claimed, can be re-applied repeatedly without injury to the threads, and with full locking strength. It is said that extensive use has been made of Dardelet track bolts by a number of foreign roads, and that the results have been successful.

The profile of the Dardelet thread, which is of the square type, has a slope at the root of the male thread which rises toward the point of the bolt, and a corresponding slope on the ridge of the female thread. This slope, which is at an angle of six degrees, is called the



A Longitudinal Section Through a Dardelet Bolt and Nut

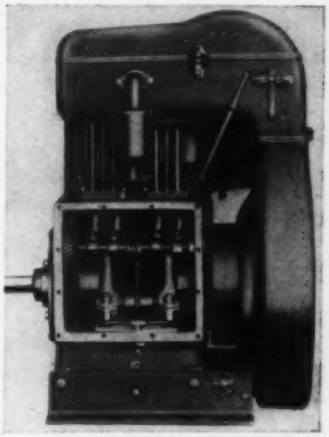
locking slope, or angle. The threads are of such cross-sectional contour as to allow axial play between the nut and the bolt within fixed limits, and therefore, when not under load, the nut is finger-free. While in engagement, the opposed sloping faces of the thread are jammed against each other by a crosswise wedging movement, locking them together securely.

When a Dardelet nut is applied on a bolt with the Dardelet thread, the nut is advanced along the bolt with the conical surfaces lightly in contact. When the nut seats the conical surfaces of the root of the male thread and the corresponding ridge of the female thread, are forced into closer contact and the material of the nut is stretched within its elastic limit until the approximately square abutment faces of the thread are in contact. The nut is then under stress, and is locked to the bolt by frictional adherence. If it is necessary to tighten the nut, it can be further rotated, and throughout this stage it retains its locking grip on the bolt.

In spite of the locking friction which must be overcome in tightening the nut, it is claimed that the effort required to bring a given pressure on the work is actually less than that necessary to do the same work in the case of a standard V thread. This, it is said, is due to the fact that the friction set up by a 60-deg. V thread under a given load, is greater than the combined friction in the Dardelet thread assembly of the conical surfaces and the practically square abutment thread faces which take the load.

"New-Way" Twin Air-Cooled Engine

THE New Way Motor Company, Lansing, Mich., has developed and placed on the market a new air-cooled two-cylinder internal-combusion engine, which it has designated the "New-Way" Twin No. 2. The engine can be operated with gasoline, kerosene, alcohol, and natural or artificial gas, and is said to be capable of developing from 6 to 10 brake horsepower at speeds up to 1,800 r. p. m.



The "New-Way" Twin No. 2 Engine with Inspection Plate Removed

The assembly and housing of the engine are so arranged that all parts are easily accessible for inspection, adjustment or repairs. The cylinders are of the valve-in-head type, with detachable heads, permitting the removal of the valves for grinding and their replacement quickly, while the removal of a large inspection plate on the side of the housing affords access to the moving parts.

The system of cooling is the same as is used in other "New-Way" engines, consisting of a flywheel with curved blower blades around its periphery. As the wheel revolves it expels the air in the wheel housing, causing outside air to be drawn through the jackets around the cylinders, absorbing the heat, after which it is drawn into the wheel housing and expelled by the blower action of the flywheel. A high-tension flywheel magneto is used and an air-operated governor is provided which can be adjusted for speeds ranging from 400 to 1,800 r. p. m., and which is said to control the speed with less than five per cent variation between no load and full load.

These engines are furnished with five types of power takeoff to adapt them to any kind of service within the limits of their capacity.

Make Wrought Iron by New Process

THE superiority of wrought iron over rolled steel in resisting corrosion is well known, but owing to the limitations of the process of manufacture, it has not been able to compete with steel in quantity production or price. For this reason, the recent announcement of the perfection of a method for the manufacture of wrought iron, which replaces the old hand puddling method with a process that employs equipment and methods comparable to those employed in steel making, is of unusual interest.

In the old process of manufacturing wrought iron, there are three essential steps: The melting of the ore or pig iron, the refining of the iron, and finally, impregnating the iron with a slag of the correct chemical proportion. All of this is done in the one furnace, and after this process is completed the metal in the form of a soft, spongy mass, is drawn from the furnace to be worked by squeezing and rolling. This is largely the hand work of the puddler and requires great physical

A 2,000-lb. "Sponge" as It Leaves the Thimble

effort and a high degree of skill. It is a slow process and because of the manual labor involved is expensive.

In the new process, which was developed by Dr. James Aston, and is controlled by the A. M. Byers Company, Pittsburgh, Pa., the melting of the pig iron is done in a cupola having a capacity of about 20 tons an hour. The pig iron, made from Bessemer ore, has an analysis of 1.5 per cent silicon, 1 per cent maganese, 0.05 per cent sulphur, and 0.08 to 0.10 per cent phosphorus. The metal in the cupola absorbs a small amount of sulphur from the coke, and since this is an undesirable element, the liquid metal is subjected to a special process while being poured into the ladle in order to reduce its sulphur content.

Roughly, about two tons of metal are tapped at one time. The metal is then poured into a converter for refining, following which it is poured into a bath of slag. This latter process is known as "shotting." When the stream of iron comes into contact with the slag, the gases liberated create millions of tiny explosions, which, in turn, cause the metal to be broken up into pea-size globules, exactly as in the puddling furnace when the metal is "coming to nature." It is said that the reactions in the new process are similar in every respect to those which take place in hand puddling, except that they are completed at a much faster rate, and with greater uniformity.

When the necessary reactions are completed, the ladle is tipped until the excess slag has been poured off. The material remaining in the bottom of the ladle is called the sponge, from which a spongy ball is formed, weighing approximately 2,200 lb. The composition of the material in this spongy mass is similar to that in the ball obtained in the puddling furnace. This spongy mass is placed under a hydraulic press where the surplus slag is squeezed out and the iron pressed into a rectangular form with a cross-section of 12 in. by 14 in., and a length of 5 ft. This ingot-like block is passed through a rolling mill and reduced to the form of a bar approximately 200 ft. long by 4 to 8 in. wide and ¾ in. thick.

With the new process, it is said that as much wrought iron is produced in 20 min. as can be turned out by two puddlers in a 10-hr. day. With the development of facilities for the application of this process on a large scale, it is anticipated that reductions in prices of wrought iron products will be made, which will not only result in an increase in the use of wrought iron for pipe but will also lead to its greater application in other forms. It is claimed that finished products made from this new process wrought iron are superior to those made from hand-puddled iron.

Demountable Seat Permits Push Car to Do Double Duty

A SEAT frame which can be applied or removed quickly to transform a push car into a trailer for the transportation of men has been developed by Fairmont Railway Motors, Inc., Fairmont, Minn., as auxiliary equipment for its seven-foot cars for either standard or extra heavy duty. Shifting of the

The Seat Frame Is Removed or Replaced Easily

seat on the deck of the car is prevented by lugs, thus avoiding the use of bolts for this purpose, with consequent delay in putting on or taking off the seat.

The seat frame is provided with safety rails and with foot guards which extend beyond the wheels. By the use of this seat, which is said to have given satisfactory service on a number of railways, the push car is able to do double duty where large gangs are employed, eliminating the necessity of providing trailers for the sole purpose of transporting the men in safety.

A New Current Retard

A NEW system of current retards designed especially for use in the smaller, non-navigable streams has been developed and applied with success by Wood Brothers Construction Company, Lincoln, Neb. This company is the originator and constructor of other forms of river bank protection, notably the type of current retard in which great masses of trees are secured in the stream along cutting banks by means of cables and concrete piles jetted to great depths below the river bed. This older form of protection has proved effective under severe conditions, such as are encountered in large streams like the Missouri river, but its application to non-navigable streams involves certain complications and entails costs that are unwarranted where the conditions are not so severe. It is in such cases that the newer form of construction, a structural steel retard, functions most satisfactorily and at a cost that is proportionate to the conditions it must meet.

The material used is structural steel angles ranging from 3-in. by 3-in. by ⅜-in. to 5 in. by 5-in. by ⅜-in., in lengths ranging from 8 ft. to 20 ft. Two such angles are combined to form a T shape but, as set in position with the base of the stem and one end of the cross member resting on the ground, they form really an A-frame with one leg projecting beyond the apex. Two such A-frames, connected by a longitudinal member, form a construction unit and a series of these units set in a row, with the short legs of the A-frames on the down stream side, serve as the framework for a single steel jetty extending out into the stream from the eroded bank.

After being set in place, this frame is tied together by a series of ⅜-in. cables extending longitudinally from the outer end of the frame to the bank every two feet of its height. These cables pass through holes punched in the vertical legs of the upstream angles and, in addition to their function as ties, serve like the purlins in a roof frame to support concrete reinforcing mesh (triangular wire mesh, for example) that is placed over the entire upstream face and securely wired in place.

Another important feature of the construction is a bankhead consisting of a mass of trees placed butts upstream to fill the space between the river end of the jetty and the slope of the bank. This is held in place by the ⅜-in. cables extending lengthwise of the retard, which are wound around it and then extended to a bank anchor consisting of a log or deadman buried in the ground well back from the river bank. Additional anchorage for the retard is provided by separate cables attached to the retard at intervals of 12 ft. along its length, which are run diagonally upstream to other bank anchors.

Successive Stages in the Building of a Steel Retard and the Result Obtained

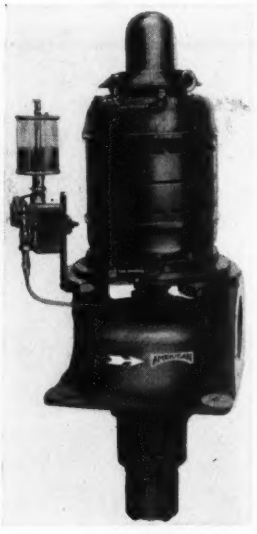
Supplementing the steel jetty, there is a tree screen consisting of trees laid on the stream bed with butts upstream just behind the jetty. The jetty and the tree screen form a complete retard, which has the effect of reducing the velocity of the flow of water through it, thereby causing the water to deposit a part of its load of suspended matter. The sedimentation process thus set up builds up a bar in front of the bank that has been cutting.

The number of retards required, their location and spacing depend upon local conditions and are determined by the engineers of the Woods Brothers Company, based on a study of the site and a knowledge of

stream action acquired by long experience in work of this character. In addition to installations of this type of retard made for county authorities and highway commissions in Iowa, Nebraska, Kansas and other states, several have been made for the Chicago, Burlington & Quincy.

New "American" Turbine for Small-Bore Deep Wells

IN ORDER to provide turbine pumping units for deep wells of small diameter, the American Well Works, Aurora, Ill., has developed and placed on the market turbines which can be used for six-inch and eight-inch wells. Each unit consists of a turbine head housing a vertical electric motor, a supporting pipe which encloses the driving shaft, and a turbine pump embodying the special features of other "American" turbines and which can be supplied with the number of stages necessary for the specific requirements.



"American" Turbine Head for Small Deep Wells

The motor is mounted on a compact and rigid base, the thrust bearing of the motor being designed to carry the load of the driving shaft and the impellers. The supporting pipe, the lower end of which carries the turbine casing, is attached to the lower part of the turbine head. All bearings are oil lubricated by gravity from the surface, the feed being controlled electrically. The discharge pipe is located above the floor level to permit easy access and provision is made for the drainage of all waste oil and water leakage.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 15-17, 1929, New Orleans, La.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 11-13, 1930, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 28-30, 1930, Seattle, Wash.

Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds, secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, spring of 1930, date and place to be announced later.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 17-19, 1929, Chicago.

Track Supply Association—L. C. Ryan, secretary, Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

BRIDGE AND BUILDING ASSOCIATION.—The Executive committee will meet at the Chicago Engineers' Club, Chicago, on Saturday, June 22, to plan for the next convention, which will be held in New Orleans, La., on October 22-24, and to consider other problems confronting the association.

WITH THE ASSOCIATIONS

The Roadmasters Association

Meetings of the executive committees of the Roadmasters and Maintenance of Way Association and of the Track Supply Association will be held at the Hotel Stevens early in July. These meetings will be devoted largely to the perfection of definite arrangements of each of the associations for the conduct of the convention and exhibit to be held concurrently in that hotel on September 17 to 19, inclusive. The Track Supply Association has sent applications for membership and for exhibit space to companies interested in the exhibit of track materials which will be presented in connection with the Roadmasters Convention and the returns that have been received to date indicate the exhibit will be the largest in the history of the organization.

American Railway Engineering Association

Following the meeting of five committees of the association during the month of April, three other standing committees held meetings during the month of May. The Committee on Track held a meeting at St. Augustine, Fla., on May 7, with 26 members present; the Committee on Rail met at New York on May 10, the Committee on Iron and Steel Structures met at Columbus, Ohio, on May 16-17 with 21 present, and the Committee on Wood Preservation met at Texarkana, Ark., on May 21 with 12 present. In addition, the committee on Arrangements held a meeting at Savannah, Ga., on May 5 and 6 and a number of sub-committee meetings have been held to supplement those of the main committees. On June 7 the Committee on Records and Accounts and the Committee on Uniform General Contract Forms will meet at Cleveland and New York respectively. The Committee on Economics of Railway Operation will meet at Pittsburgh on June 13. The Board of Direction will meet at St. Louis, Mo., on June 12.

The Wood-Preservers Association

Approximately 85 members of the American Railway Engineering Association and the American Wood-Preservers Association met at Texarkana, Ark.-Tex., on May 21-22 in the annual summer meeting of committees of these two organizations interested in the treatment of timber. The first day was given over largely to the meeting of the A. R. E. A. Committee on Wood Preservation and the second day to meetings of the Executive and other committees of the American Wood-Preservers Association. The afternoons of the two days were occupied by inspections of the treating plants of the International Creosoting and Construction Company and the National Lumber and Creosoting Company. On Tuesday evening, the two groups joined in an informal dinner at which more than 100 persons were present.

The Executive committee of the Wood-Preservers Association considered particularly the plans for the next annual convention which will be held in Seattle, Wash., on January 28-30, 1930, and arranged tentatively for several papers to be presented at that meeting in addition to the reports of standing and special committees.

RAILWAY NEWS BRIEFLY TOLD

Five New England roads, the New York, New Haven & Hartford, the Boston & Maine, the Boston & Albany, the Bangor & Aroostook and the Maine Central, will expend a total of $44,695,000 during 1929 for improvement, as compared with some $20,000,000 in 1928, according to a survey conducted by the New England Council.

The Association of Railway Labor Union Executives has reached a decision to oppose certain features of the Fess railway consolidation bill and to object to any effort to bring about its consideration at the special session of Congress. Senator Fess has stated that he has no present intention of pressing the bill at the special session.

The Atchison, Topeka & Santa Fe, on June 9, will reduce the running time of its fast train, the Chief, to 58 hours in both directions between Chicago and Los Angeles, Cal., cutting the present westbound schedule five hours and the eastbound schedule 3¼ hours. On the same date, the Union Pacific will shorten the time of the Overland Limited to 58 hours in each direction between Chicago and San Francisco, Cal., as compared with the present schedule of 63 hours westbound and 61¼ hours eastbound.

The route mileage of the railways of the United States increased only 428 miles from 1916 to 1927, the construction of new mileage being offset by the length of lines abandoned. The total length of the railways of the country was 253,470 miles in 1913; 259,211 miles in 1916, and 259,639 miles in 1927. The total of all tracks, however, increased from 379,058 miles in 1913 to 424,737 miles in 1927, a gain of over 12 per cent. These figures were obtained by a survey made by the National Bureau of Economic Research, dealing with significant economic trends since the close of the war, and will be published with the report of the Committee on Recent Economic Changes of the President's Unemployment Conference.

Mrs. A. B. Mathis, wife of Alonzo B. Mathis, section foreman on the Nashville, Chattanooga & St. Louis at Halls, Ga., probably saved a passenger train from being wrecked by a broken rail at that point on February 12. While engaged in her household duties in her home, about 300 ft. from the main track, she heard an unusual noise as the southbound Dixie Limited passed and recognized it as similar to a sound she had heard when a train passed over a broken rail on a siding. Running to the track she found that a piece had been broken from a rail, and at once sent a man to call her husband, who was working three miles away, and who was able to reach the broken rail in time to flag a local passenger train which was following the limited.

Revenue freight car loadings continue substantially larger than for corresponding periods of last year. For the week ending May 11, the latest date for which information was available at the time of going to press, the total amount to 1,047,992, an increase of 45,511 cars as compared with the corresponding week in 1928 and an increase of 18,498 cars over the same week in 1927. The cumulative total for the first 19 weeks of the current year was 18,228,772, as compared with 17,512,967 and 18,470,899 for the corresponding periods in 1928 and 1927, respectively.

Angelo Viola, trackwalker on the Middle division of the Eastern region of the Pennsylvania at Mt. Union, Pa., was presented with a Heroic Service medal on April 24 by General W. W. Atterbury, president of the road, in recognition of his action in rescuing a young girl from the track in the face of an approaching passenger train at Mt. Union on July 7, 1928. As the train whistled for the station, Mr. Viola noticed two children playing on one of the main tracks about 100 ft. from him and called to them to get off the tracks. The older child obeyed at once, but the younger one began to cry and moved slowly to the track on which the train was approaching. Mr. Viola ran to the child and carried her off the track only a few seconds before the train passed the spot where the child had been standing.

The National Safety Council has announced its awards of plaques for the year 1928 for the best record for safety to employees on duty per million man-hours, excluding employees in marine departments. For the purpose of the awards, the railways are divided into seven groups, depending on their respective millions of man-hours, as follows: Group A, 100 or more; Group B, 50 to 100; Group C, 20 to 50; Group D, 10 to 20; Group E, 5 to 10; Group F, 2 to 5; Group G, less than 2. The winner in Group A was the Southern Railway with a rate of 8 per million man-hours. Winners in the other groups were: Group B: the Texas & New Orleans (Southern Pacific) with a rate of 8.91, a reduction of 60.51 per cent as compared with 1923; Group C: Oregon-Washington Railroad & Navigation Company, rate of 4.63, a reduction of 60.49 per cent since 1923; Group D: Chicago Great Western, rate 3.30, a reduction of 75.70 per cent since 1923. (This road also was second in its group for each of the four years preceding 1928); Group E: Gulf, Mobile & Northern, rate 3.15, a reduction of 89.80 per cent from 1923; Group F: Ann Arbor (Wabash) rate 2.81, a reduction of 90.91 per cent from 1923 and Group G: Texas-Mexican, which has been in Class I for only two years, in which time it has had no reportable casualties, with 1,223,000 man-hours in 1928 and 2,933,000 man-hours for the two years. No road is eligible to win a group award more than twice in succession, which apparently accounts for the absence of the Union Pacific in the list announcing the winners.

The Harvard Graduate School of Business Administration has outlined the scope of the summer session for 1929, which will extend from July 1 to August 10. The object of the railway course is to present the broad problems not ordinarily falling within the experience of the department head or junior executive and for this purpose the course is divided into two parts: Economics and administration running concurrently. The first part will treat, in a general way, of railway rates and governmental regulation, while on the administrative side, attention will first be given to the fundamental principles of organization and a discussion of interdepartmental relationships. The administrative aspects of maintenance of way, structures and equipment will also be considered. Special emphasis will be placed on the problems of the transportation department in the design and operation of yards, terminals and trains, and there will be an extended discussion of the technique of statistical control. The tuition fee will be $200 and the charges for room and board will range from $125 to $225 for those who live in the school dormitories. Applications for admission, together with an advance payment of $25 of the tuition fee, should be addressed to Miss M. B. Fox, secretary of the special session, Harvard Graduate School of Business Administration, Soldier's Field, Boston, Mass. Twenty-seven railway men, representing nine railways, were enrolled in the transportation courses in the summer session of 1928.

Construction News

The Atchison, Topeka & Santa Fe has been authorized by the Interstate Commerce Commission to construct a line of railroad from a connection with the existing line of the Kansas City, Mexico & Orient (Texas) at San Angelo, Tex., southward to Sonora, 65 miles, at an estimated cost of $2,200,000.

This road the Los Angeles & Salt Lake, and the City of Los Angeles have applied to the Railroad Commission of California for permission to construct the proposed Sixth Street viaduct over the Los Angeles river and the tracks of the two railroads. The estimated cost of the project, including the construction of an underpass under the tracks of the Atchison, Topeka & Santa Fe, is $2,162,900. Under the terms of an agreement the Salt Lake will expend $125,700 for the construction of an elevated track structure from the river bank to the Southern Pacific passenger station and an elevated structure for the use of the Pacific Electric. Of the balance of the cost the city will bear 75 per cent and the two railroads 12.5 per cent each.

The Baltimore & Ohio has awarded a contract to the Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., for the construction of water treating plants at Foster, W. Va., and Jacksonburg. Bids have been received for the construction of a water treating plant at Zanesville, Ohio.

This road together with the Indiana Harbor Belt, the Michigan Central and Cook County (Ill.) will share in the cost of the construction of a bridge and viaduct, 3,500 ft. in length, over the Calumet river and a number of railroad tracks at One-hundred Forty-third street and Burnham avenue, Chicago, estimated to cost $778,000.

This road, the Chicago, Burlington & Quincy, the Pennsylvania and the St. Charles Air Line plan, subject to the approval of the City Council, the elimination of the railway crossings at Fifteenth street and Stewart avenue, Chicago, which will do away with about 746 train stops a day. The cost of the entire project is estimated at $5,000,000, with $3,000,000 chargeable to separation of grades, and necessary track changes involving an expenditure of about $2,000,000. It is planned to elevate the tracks of the St. Charles Air Line and the Baltimore & Ohio above those of the Chicago, Burlington & Quincy and the Pennsylvania.

The Canadian National, during 1929 plans to construct a second main track and revise grades between Middleboro, Man., and South Junction, 4.2 miles; between Woodbridge, Man., and Baynham, 6.2 miles; and between South Saskatoon, Sask., and Chappell Junction. The first two projects will require an expenditure of about $450,000.

The Canadian Pacific has announced plans for the construction of a freight station at Vancouver, B. C., which will involve an expenditure of about $100,000.

Contracts for the grading of 177 additional miles of branch lines in British Columbia, Alberta and Saskatchewan, have recently been let by this company.

The Chesapeake & Ohio has awarded a contract to Haly, Chisholm & Morris, Charlottesville, Va., for the construction of a third track on its lines from Big Sandy Junction to Pike Crossing, near Catlettsburg, Ky., at an approximate expenditure of $300,000.

The Interstate Commerce Commission has authorized the Sewell Valley to construct an extension of its Glencoe and Due branch 1.4 miles in Greenbier County, W. Va., at an approximate cost of $715,000.

The Chicago, Burlington & Quincy has awarded a contract to the Roberts & Schaefer Company for four cinder-handling plants for installation at Eola, Ill., Savanna, Gibson, Neb., and Alliance.

This company plans the construction of a 1,000,000-bu. addition to its recently acquired grain elevator and warehouse at St. Louis, Mo.

The Chicago, Rock Island & Pacific has awarded a contract to the United Engineers & Constructors, Chicago, for the construction of a 79-ft. by 403-ft. shed at El Reno, Okla., to cost $164,279. A contract has also been awarded to C. S. Lambie, Amarillo, Tex., for the construction of a 24-ft. by 100-ft. one-story brick veneer passenger station at Stinnett, Tex., to cost approximately $12,000.

Two new air-lift wells at Hitchland, Tex., and Jo Williams, Okla., will be drilled by D. L. McDonald, Amarillo, Tex., while the installation of the air-lift pumping equipment and the construction of pump houses and other necessary facilities will be undertaken by the Railroad Water & Coal Handling Company, Chicago.

The Interstate Commerce Commission has authorized the St. Paul & Kansas City Short Line and the Chicago, Rock Island & Pacific, which latter corporation controls the former, to construct a line from Coburn, Mo., southwesterly to Birmingham, 71.45 miles.

The Erie has awarded a contract to the Staple-Munn-Beals Company, Buffalo, N. Y., for the construction of a lateral highway to eliminate four grade crossings on its lines at Arkport, N. Y.

The Fort Worth & Denver City will apply for authority to construct 110 miles of new line from Childress, Tex., northerly and northeasterly to Pampa, at a cost between $3,500,000 and $4,000,000.

The Great Northern has awarded a contract to A. Guthrie & Co., St. Paul, Minn., for the construction of second main track between Williston, N. D., and Mondak, Mont., about 23 miles. The work involves the excavation of about 500,000 cu. yd. of earth.

The Hocking Valley has awarded a contract for dredging and the construction of slips and docks in connection with the development of the Presque Isle terminal at Toledo, Ohio, to the Great Lakes Dredge & Dock Company, Chicago, at a cost of about $1,750,000. The construction of new yards which will have a combined capacity of 5,075 cars will be undertaken by company forces at an estimated cost of $700,000.

The Kentucky & Indiana Terminal has announced that bids will be taken to enable work to start within 90 days on the elimination of grade crossings by the elevation of tracks along Thirty-first street between Market street and Garland avenue at Louisville. The cost of the project is estimated at $1,000,000.

The Michigan Central has let a contract to D. W. Thurston, Detroit, Mich., for the renewal of a bridge over Kettle creek, at St. Thomas, Ont., at a cost of about $400,000.

The Missouri Pacific has announced plans for the raising of track and the construction of flood protection works at two points on the Central Kansas division which will involve an expenditure of about $157,210.

The Mound City & Eastern has awarded a contract to Winston Brothers Construction Company, Minneapolis, Minn., for the laying of rail and the construction of bridges and culverts on the line which is under construction between Mound City, S. D., and Leola, 70 miles.

The Nashville, Chattanooga & St. Louis has under consideration plans for the construction of a new station, a 17-story office building and a storage warehouse at Atlanta, Ga., estimated to cost $3,000,000.

The New York Central has awarded a contract to H. H. Sherwin & Co., Inc., New York, for the construction of approaches to a bridge on its line at Tremont avenue in New York, at a cost of about $125,000. Work has been begun on the project.

Bids have been received for the elimination of the Odell avenue crossing on its lines at Gray Oaks station, Yonkers, N. Y., estimated to cost about $140,000.

The New York, New Haven & Hartford has awarded two contracts to the Tredennick-Billings Company, Boston, Mass., one for office extensions to warehouses 10 and 11 in connection with the fruit terminal facilities in Fargo street, Boston, to cost about $150,000, and the second for new platform facilities and concrete driveways for the same terminal at an expenditure of about $50,000. A contract also has been given to C. W. Blakeslee & Sons, New Haven, Conn., for the reconstruction of a bridge to permit the widening of Sound Beach avenue, in Greenwich, Conn. This has been estimated to cost $100,000.

The Owensboro-Rockport Bridge Company has been authorized by the Interstate Commerce Commission to

construct a line of railroad from Owensboro, Ky., to Rockport, Ind., approximately 12 miles, involving a joint railway and highway bridge over the Ohio river in the vicinity of Owensboro; at an estimated cost of $5,203,275, of which $3,454,000 represents the cost of the bridge.

The Pennsylvania has applied to the Interstate Commerce Commission for authority to build a branch line from Duck Creek to East Norwood, Ohio, 1.2 miles, to connect with the tracks of the Baltimore & Ohio. The Pennsylvania and the Norfolk & Western have applied to the commission for authority to use the tracks of the Baltimore & Ohio from East Norwood to a junction with the passenger tracks of the Cincinnati Union Terminal Company.

A contract has been awarded to the Vare Construction Company, Philadelphia, Pa., for the construction of foundations for the support of the electrification structures on this company's lines between North Philadelphia and Liddonfield, Pa., at an approximate cost of $300,000.

The Pere Marquette has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a two-track, automatic electric shallow-pit coaling plant of 250-tons capacity, together with sanding facilities at Lake Michigan.

The Pittsburgh & West Virginia has awarded contracts for the erection of the superstructure and the construction of the substructure of an 800-ft. bridge at Cochrans Mills, Pa., at a cost of $100,000, to the American Bridge Company, Pittsburgh, Pa., and to Greeley & Holmes, Pittsburgh, respectively. A general contract has been let to the McClinic Marshall Company, Pittsburgh for the construction of a steel and concrete bridge, 2,500 ft. in length, over Pidgeon creek near Donora, Pa. The cost of this structure is estimated at $250,000. The American Bridge Company and Greeley & Holmes have also been awarded contracts for the construction respectively of the superstructure and the substructure of a bridge over Peters creek at Gastonville, Pa. This bridge will consist of a 200-ft. truss span and a 100-ft. girder span and will require as estimated expenditure of $100,000.

The Texas & Pacific has announced that tentative plans are under consideration for the construction at that point of new passenger and freight terminals which it is estimated will require an expenditure of $8,000,000.

The Union Pacific has awarded a contract for furnishing the steel for the construction of a grade crossing elimination structure at University avenue, Laramie, Wyo., to the Omaha Steel Works. A contract has been awarded to Nels Swenson, Laramie, for the construction of the abutments, while the erection of the steel will be undertaken by company forces. The cost of the structure, about $200,000, is being borne by the city and the railway.

Supply Trade News

General

The Ramapo Ajax Corporation, New York, has moved its New York office to 230 Park avenue.

William Robertson & Co., Chicago, have moved their offices to 360 North Michigan Avenue.

The Foote Bros. Gear & Machine Company, Chicago, has moved its general offices from 215 North Curtis street to 111 North Canal street.

The Johns-Manville Corporation, New York, has moved the headquarters of its western division from Michigan avenue and Eighteenth street to 230 North Michigan avenue, Chicago.

The Alemite Manufacturing Corporation, Chicago, has purchased the Dot Lubricator division of the Car Fastener Company, Cambridge, Mass., and has consolidated it with its railroad department.

J. D. Wallace & Co., Chicago, manufacturers of portable woodworking machinery, have taken over the John T. Towsley Manufacturing Company, Cincinnati, Ohio. The latter company will continue as a separate corporation, operating as a division of J. D. Wallace & Co.

The Rail Joint Company, New York, control of which has been acquired by Poor & Co., Chicago, by the purchase of 96 per cent of the stock, will continue to be operated as a separate company, with **V. C. Armstrong** as president. **Fred A. Poor** was elected chairman of the board of the Rail Joint Company on April 29.

The Industrial Brownhoist Corporation, Cleveland, Ohio, has purchased the McMyler Interstate Company, Bedford, Ohio. The McMyler plant, machinery and materials are not included in the purchase, but the manufacturing operations and business of the McMyler Company, together with all drawings and records, will be moved to the Cleveland plant of the corporation.

The Oxweld Railroad Service Company, Chicago, has organized a new department for the sale of special equipment to railroads, including the Oxweld railroad lamps formerly sold by the Union Carbide Sales Company, Carbic flood lights, and generators, Presto-O-Lite motor car headlights and other equipment of similar nature, together with supplies for use with these products.

The Binks Manufacturing Company has been formed as a reorganization of the Binks Spray Equipment Company, manufacturer of spray-painting equipment. **Neil C. Hurley,** formerly president and chairman of the board of the Hurley Machine Company, has been elected president of the new company, and J. F. Roche, formerly manager of the Montana Power Company, vice-president of the Apex Electric Distributing Company and assistant to the president of the Edison Electric Appliance Company, has been elected executive vice-president and treasurer.

The Delaware Wood Preserving Company has been organized as a subsidiary of the Century Wood Preserving Company, Pittsburgh, Pa., to build and operate a timber-treating plant at Wilmington, Del. Three hundred acres of land have been acquired for seasoning and storage yards and two treating cylinders will be installed, with provision for others as needed. **H. R. Condon** has resigned as general manager of the American Mond Nickel Company, Pittsburgh, to become vice-president and general manager of the new company, with headquarters at 1002 Finance building, Philadelphia, Pa.

Personal

Joshua A. Logan has been elected president of the National Lumber & Creosoting Company, Texarkana, Ark.

A. H. Told, general manager of the Positive Rail Anchor Company, Chicago, has moved his office from 1928 West Forty-sixth street, Chicago, to 606 Railway Exchange building.

G. La Rue Masters, assistant general sales manager of the National Lock Washer Company, Newark, N. J., has been made sales manager of that organization, with headquarters at Newark.

Grant B. Shipley, consulting engineer and president of the Century Wood Preserving Company, Pittsburgh, Pa., has moved his office to 3010 Koppers building, Pittsburgh.

W. J. Church has been appointed district representative of the Louisville Frog, Switch & Signal Company, Louisville, Ky., with headquarters at 1803 Canal Bank building, New Orleans, La.

Henry A. Squibbs, manager of the fence and post sales department of the American Steel & Wire Company, Chicago, has been promoted to assistant general manager of sales, with headquarters, as heretofore, at Chicago.

D. Cameron, roadmaster on the Chicago, Burlington & Quincy, with headquarters at Hannibal, Mo., has been appointed service engineer for the Chipman Chemical Engineering Company, Bound Brook, N. J., with headquarters at Chicago.

R. S. Arthur, formerly in charge of the Chicago office of the Dravo Equipment Company, has been appointed manager of the midwestern branch office, which the Aeroil Burner Company, West New York, N. J., opened recently at 176 North Wacker Drive, Chicago.

D. S. Ellis, formerly assistant engineer of motive power of the New York Central Lines, with headquarters

at New York, has been appointed eastern district sales manager of the Worthington Pump & Machinery Corporation, with headquarters at the Harrison works, Harrison, N. Y.

B. S. Crooks, general superintendent of **A. Guthrie & Co., Inc.**, St. Paul, Minn., has been elected vice-president, and **W. E. Conroy**, a superintendent for the company, who was recently resident superintendent on the Cascade tunnel, has been promoted to general superintendent, with headquarters at Cleveland, Ohio.

J. Howard Horn, formerly general manager of sales of the National Lock Washer Company, Newark, N. J., and a past president of the Track Supply Association died at his home, Mason's Island, Conn., on May 13. Mr. Horn was born in September, 1885, and graduated from Princeton University in 1907. Beginning work with the Cooke Locomotive Works, Paterson, N. J., he was later engaged in the advertising business in New York. He entered the service of the National Lock Washer Company in 1910 and was promoted to general manager of sales in 1925. On account of ill-health, Mr. Horn had not been active in business for the last two years.

J. J. Saelens, formerly with the Union Carbide Sales Company, has been appointed manager of the new department which the Oxweld Railroad Service Company has organized for the sale of special equipment to the railways. Mr. Saelens was born in Chicago and became associated with the Union Carbide Sales Company in 1913, with whom he served in various

J. J. Saelens

capacities until the time of his recent appointment in charge of the newly-organized department of the Oxweld Railroad Service Company. For the last four years he has devoted all of his time to the railroad lamp department.

W. J. Smith, whose resignation as tie and timber agent of the Missouri-Kansas-Texas, with headquarters at Denison, Tex., to become president of the newly-formed W. J. Smith Wood Preserving Company at Denison was noted in the May issue, entered railway service in the engineering department of the Chicago & Eastern Illinois in 1907, following his graduation from Ohio State University. In 1912, he was placed in charge of timber preservation on the Pittsburgh & Lake Erie and in 1917 was appointed superintendent of the timber department of the Missouri-Kansas-Texas. In 1920, he was promoted to tie and timber agent, with headquarters at Denison, which position he was holding at the time of his resignation to become president of the W. J. Smith Wood Preserving Company.

John T. Logan, president of the National Lumber & Creosoting Company, Texarkana, Ark., whose death on April 12 was noted in the May issue, was born on December 1, 1862, at Mans-

John T. Logan

field, La. He entered railway service as a telegraph operator at Mansfield and from 1885 to 1896 was in the employ of an express company, serving as messenger route agent and auditor in Texas. From 1896 to 1903, he was traffic manager for various railways and was also engaged in construction work at Juarez, Mex., El Paso, Tex., and Douglas, Ariz. In 1903, he entered the wood-preserving industry at Texarkana as vice-president of the National Lumber & Creosoting Company and shortly after was elected president, which position he was holding at the time of his death.

Trade Publications

The Buckeye Utility Crane.—The Buckeye Traction Ditcher Company, Findlay, Ohio, has issued a folder describing its gasoline-operated crane mounted on crawler treads. The folder is illustrated with views of the crane engaged in various kinds of work.

Graver Hot-Process Water Softener.—The Graver Corporation, East Chicago, Ind., has issued a 12-page catalog describing its hot-process water softener, which utilizes thermal action to hasten the chemical action in precipitating injurious ingredients. The catalog is illustrated with views of installations of this process and of the various parts of the mechanism, together with a colored diagrammatic view of a typical plant, showing the flow of the water and chemical.

Personal Mention

General

J. P. Harahan, assistant cost engineer on the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to assistant trainmaster with headquarters at Ronceverte, W. Va. Mr. Harahan entered the service of the C. & O. on July 1, 1925, as a rodman on location work and was promoted to masonry inspector on February 1, 1927. On September 1 of the same year he was further promoted to assistant cost engineer at Richmond, which position he was holding at the time of his recent promotion to assistant trainmaster.

Robert E. Woodruff, assistant vice-president of the Erie, and an engineer by training and experience, has been promoted to vice-president in charge of operations, with headquarters at the same point. Mr. Woodruff, after reaching the position of division engineer on the Erie, entered the operating department, where he advanced to general manager of the Eastern division in 1927. A more extended sketch of Mr. Woodruff's railway career, together with his portrait, was published in the January issue of *Railway Engineering and Maintenance* at the time of his promotion to assistant vice-president.

John K. Johnston, superintendent of the Tyrone division of the Pennsylvania, with headquarters at Tyrone, Pa., whose railway experience embraces both engineering and maintenance of

John K. Johnston

way, has been promoted to assistant general superintendent of the Eastern Pennsylvania division, with headquarters at Tyrone. Mr. Johnston was born on May 8, 1860, at Pleasant Unity, Va., and entered railway service as a chainman on surveys on the Pennsylvania. After serving two years on the location and construction of branch lines he advanced by successive promotions to supervisor, in December, 1889, and to assistant engineer in 1896, serving in this capacity on various divisions. He was promoted to principal assistant engineer at Altoona, Pa.,

in November, 1902, and a year later was further promoted to superintendent of the Tyrone division, which position he held continuously until the time of his recent promotion to assistant general superintendent, with the exception of the interval from October, 1917, to February, 1918, when he was superintendent of the Philadelphia division.

Noel W. Smith, assistant to the general manager of the Eastern region of the Pennsylvania, with headquarters at Philadelphia, Pa., an engineer by training and experience, has been promoted to general superintendent of motor service, with headquarters at Philadelphia. Mr. Smith was born on December 25, 1869, at Williamsport, Pa., and was educated at Lehigh University. He

Noel W. Smith

entered railway service on July, 1887, as a clerk on the Pennsylvania and in May, 1893, was made a rodman on the same road. He was promoted successively to assistant supervisor, supervisor and assistant engineer until 1909, when he was promoted to division engineer at Altoona. In 1910, he entered the operating department as superintendent of the Central division at Media, Pa., and was transferred to the Middle division at Altoona in June, 1913. He was promoted to general superintendent of the Eastern Pennsylvania division in 1918 and in March, 1920, was further promoted to assistant general manager of the Central region. He was later transferred to the Eastern region and was furloughed in July, 1924, for service with the government to the Alaska railroad. He returned to the Pennsylvania in August, 1928, as assistant to the general manager of the Eastern region, which position he was holding at the time of his recent promotion to general superintendent of motor service.

R. T. Morrow, assistant to vice-president on the Central region of the Pennsylvania at Pittsburgh, Pa., who is an engineer by training and experience, has retired after almost 52 years in the service of that company. Mr. Morrow was born on March 2, 1859, at Oswego, N. Y., and was educated at Lehigh University. He entered railway service at the shops of the Northern Central (now a part of the Pennsylvania). In 1882, he became a rodman on the Philadelphia & Erie (now also a part of the Pennsylvania) and was promoted successively to assistant supervisor, supervisor and assistant engineer, serving in these positions on various divisions of the parent company and its subsidiaries until he entered the operating department as assistant superintendent in 1903. He was promoted to superintendent in the same year and in 1924 was promoted to assistant to the vice-president of the Central region, which position he was holding at the time of his recent retirement.

Walter W. Greenland, superintendent of the Western division of the Wabash at Moberly, Mo., whose railway training was in the engineering field, has been promoted to general superintendent of the Western district, with headquarters at St. Louis, Mo. Mr. Greenland was born on January 8, 1874, at Clarion, Pa., and graduated from Pennsylvania State College in 1896. He entered railway service in 1897 as a rodman on the Union Pacific, where he was advanced successively to instrument man and inspector of bridges. In 1900, he became a draftsman and inspector on the Pennsylvania and in the following year entered the employ of the Wabash where he served as transitman, resident engineer at Moberly, assistant engineer at Decatur, Ill., and Moberly, and division engineer and engineer maintenance of way at the latter place until 1918, where he was promoted to superintendent of the Western division, which position he was holding at the time of his recent promotion to general superintendent.

Engineering

J. T. Crump, assistant cost engineer on the Chesapeake & Ohio at Richmond, Va., has been promoted to assistant division engineer, with headquarters at the same point, to succeed **J. W. Knapp, Jr.,** who has been appointed supervisor of track, with headquarters at Richmond.

W. H. Vance, assistant engineer maintenance of way of the Missouri Pacific, with headquarters at St. Louis, Mo., has been promoted to acting engineer maintenance of way, with headquarters at the same point, to succeed **A. A. Miller,** who has been granted a leave of absence. **R. M. Smith,** division engineer of the Memphis division, with headquarters at Wynne, Ark., has been promoted to assistant engineer maintenance of way, with headquarters at St. Louis, to succeed Mr. Vance, and **C. J. Jaeschke,** assistant engineer at Pueblo, Colo., has been promoted to division engineer to succeed Mr. Smith at Wynne.

Frederick Auryansen, bridge engineer of the Long Island, with headquarters at Jamaica, N. Y., has been appointed assistant bridge engineer of the New York zone of the Pennsylvania, with headquarters at the Pennsylvania station, New York, following the consolidation of the Long Island with the New York division of the Pennsylvania to form the New York zone of the latter road. **R. J. Smith,** supervisor of track on the Eastern division of the Pennsylvania, with headquarters at Downington, Pa., has been promoted to assistant division engineer of the Panhandle division of the Central region, with headquarters at Pittsburgh, Pa.

Howard E. Boardman has been appointed construction engineer of the Boston & Maine, with headquarters at Boston, Mass., succeeding **Charles L. Griffin,** who has been granted a leave of absence.

H. T. Rights, assistant bridge engineer of the Lehigh Valley, has been promoted to bridge engineer, with headquarters at Bethlehem, Pa., to succeed **F. E. Schall,** who has been appointed consulting engineer.

D. W. Gross, assistant to the president of the Atlantic City Line, with headquarters at Wilmington, N. C., has been appointed chief engineer of the Winston-Salem Southbound, with headquarters at Winston-Salem, N. C., succeeding **J. E. Willoughby,** who remains chief engineer of the Atlantic Coast Line.

H. I. Hoag, general inspector of track on the New York Central in the office of the engineer maintenance of way at New York, has been promoted to division engineer of the Rochester division, with headquarters at Rochester, N. Y., where he succeeds **J. H. Kelly,** who has been transferred to the River division, with headquarters at Weehawken, N. J., to take the place of **J. W. Stevens,** whose death was noted in the April issue.

H. B. Barry, principal assistant engineer of the St. Louis-San Francisco, with headquarters at St. Louis, Mo., has been promoted to assistant chief

H. B. Barry

engineer, with headquarters at the same point, and the office of principal assistant engineer has been abolished. Mr. Barry was born on May 19, 1880, at Hillsboro, Ill., and was educated at the University of Illinois. He entered railway service in July, 1902, with the St. Louis, Memphis & Southeastern (now a part of the Frisco) and from 1903 to 1904 was an instrumentman on construction on the El Paso & Southwestern (now a part of the Southern Pacific) in Arizona, following which he

was an instrumentman on location on the S. P. He entered the service of the Frisco in 1906 as an instrumentman on maintenance of way and in 1907 was promoted to assistant engineer. In 1911 he was promoted to district engineer with headquarters at Chaffee, Mo., and in 1916, was transferred to Memphis, Tenn. He was further promoted to principal assistant engineer, with headquarters at St. Louis, on March 1, 1920, which position he was holding at the time of his promotion to assistant chief engineer on May 1.

M. C. Cleveland, principal assistant engineer of the Lehigh Valley, has been promoted to assistant chief engineer with headquarters, as heretofore, at New York. Mr. Cleveland was born at Wellesley Hills, Mass., on March 26, 1877, and was educated at the Case School of Applied Science, entering railway service in June, 1901, as an instrumentman on the Baltimore & Ohio. In the following year, he was appointed assistant engineer maintenance of way of the Indianapolis division of the Cleveland, Cincinnati, Chicago & St. Louis, and was transferred to the Cleveland division in 1904, later becoming engineer maintenance of way of the Peoria & Eastern. In June, 1907, he was appointed division engineer on the Michigan Central. From October, 1910, to August of the following year, he was special engineer on the staff of the vice-president of the New York Central Lines, west of Buffalo, following which he was appointed engineer maintenance of way of the Chicago, Indiana & Southern (a part of the New York Central). Mr. Cleveland was appointed valuation engineer of the Lehigh Valley in May, 1914, and was promoted to principal assistant engineer in December, 1927, which position he was holding at the time of his promotion to assistant chief engineer on May 1.

M. C. Cleveland

W. J. Kerrnan, whose promotion to assistant division engineer on the New York Central, with headquarters at Rochester, N. Y., was noted in the May issue, was born on November 24, 1896, at Albany, N. Y., and was educated at Rensselaer Polytechnic Institute. He entered railway service with the New York Central, on August 1, 1917, as a chairman in the engineering corps at Albany, and was later promoted to transitman. On September 13, 1918, he obtained leave of absence to enlist in the United States Navy. He returned to the New York Central on August 1, 1920, as bridge inspector at Utica, N. Y., and on November 1, 1921 he was transferred to Albany, where he was located at the time of his recent promotion to assistant division engineer.

Lem Adams, roadway assistant of the Union Pacific System, with headquarters at Omaha, Neb., has been promoted to general supervisor of maintenance of way, with headquarters at Omaha. Mr. Adams was born on June 6, 1886, at Buda, Tex., and graduated from the Agricultural and Mechanical College of Texas. He entered the service of the Union Pacific System in June, 1909, as a rodman on the Oregon Short Line, where he served successively as draftsman, estimator and chief draftsman until March, 1916, when he was promoted to assistant division engineer. He was appointed engineering accountant in 1917 and contract engineer in 1918. In August, 1919, he was transferred to the Union Pacific unit of the system as special field engineer in the maintenance of way department and in April, 1920, he was promoted to roadway assistant on the staff of the president of the system, with headquarters at Omaha, which position he was holding at the time of his promotion to general supervisor of maintenance of way on May 15.

Lem Adams

R. L. Kittredge, whose promotion to assistant division engineer on the Chesapeake & Ohio, with headquarters at Huntington, W. Va., was noted in the May issue, was born on January 29, 1901, at Cincinnati, Ohio, and was educated at the University of Cincinnati. While still in college, he entered railway service with the Baltimore & Ohio in October, 1921, as an assistant on an engineering corps, and in November, 1923, he became assistant division engineer on the C. & O., at Richmond, Va. In September, 1924, he was appointed assistant supervisor of track at Covington, Ky., where he remained until April, 1925, when he was made assistant cost engineer, with the same headquarters. In December, 1926, he was promoted to cost engineer of the Hocking Valley, with headquarters at Columbus, Ohio, where he was located at the time of his recent promotion to assistant division engineer.

M. I. Dunn, Jr., whose promotion to division engineer on the Chesapeake & Ohio, with headquarters at Huntington, W. Va., was noted in the May issue, was born on October 29, 1899, at Scottsville, Va., and graduated from Washington and Lee University in 1923. He entered railway service with the Chesapeake & Ohio on July 1, 1916, as a rodman on valuation survey work, and on December 1, 1918, he was promoted to instrumentman, which position he held until September 1, 1919, when he obtained a leave of absence to attend college. On June 15, 1923, he returned to the C. & O. as an instrumentman in the construction department at Huntington, W. Va., and on October 1 of that year he was promoted to assistant engineer in the maintenance of way department on the Clifton Forge division, at Clifton Forge, Va. On October 1, 1924, he was promoted to assistant division engineer on the Richmond division, at Richmond, Va., and on July 15, 1925, he was transferred to Huntington, where he was located at the time of his recent promotion to division engineer.

M. I. Dunn, Jr.

Track

Earl Pratt has been appointed roadmaster of the Dillon district of the Oregon Short Line at Dillon, Mont., succeeding **Frank Ivers, Jr.**, who has been transferred.

J. W. Thomas, roadmaster on the Missouri Pacific at El Dorado, Ark., has been transferred to Gurdon, Ark., to take the place of **J. W. Treadwell**, who has been transferred to El Dorado.

D. B. Carle has been promoted to assistant roadmaster of the Missouri division of the Atchison, Topeka & Santa Fe at Marceline, Mo.

A. T. Darnell, roadmaster on the Gulf, Colorado & Sante Fe, with headquarters at Cleburne, Tex., has been promoted to general track inspector, with headquarters at the same point.

S. E. Rich, extra gang foreman, has

been promoted to roadmaster of the Dallas, Paris and Honey Grove districts, with headquarters at Cleburne, to succeed **B. E. Meyer,** who has been assigned to the First and Weatherford districts to take the place of Mr. Darnell.

E. P. Fitzgerald, section foreman on the Gulf Coast Lines at Barreda, Tex., has been promoted to roadmaster, with headquarters at Raymondville, Tex., to succeed **L. B. Scott,** who has been granted a leave of absence.

J. W. Hughes, roadmaster on the Atlantic Coast Line, with headquarters at Charleston, S. C., has been promoted to general roadmaster, with headquarters at Florence, S. C., to succeed **W. Q. Jeffords,** who has retired after more than 55 years' service with that company.

R. C. Davidson, roadmaster on the Smithers division of the Canadian National, with headquarters at McBride, B. C., has been transferred to Smithers, B. C. to succeed **E. Gunderson,** who has been appointed acting roadmaster at McBride to succeed Mr. Davidson. **J. Mosnowlik** has been appointed acting roadmaster on the Smithers division at Smithers to succeed **H. Gunderson** who has been transferred to Kamloops Junction, B. C. **Hector McPhail,** roadmaster at Allandale, Ont., has retired after 46 years' service.

F. H. DeMoyer, whose promotion to supervisor on the Pennsylvania, with headquarters at Jamesburg, N. J., was noted in the May issue, was born on January 14, 1902, at Pottsville, Pa., and graduated from Lehigh University in 1923. On June 15 of that year he started work with the Pennsylvania as a rodman at Chambersburg, Pa., serving in this capacity also at Baltimore, Md., and Camden, N. J., until November 15, 1926, when he was promoted to assistant supervisor on the Long Island, with headquarters at Jamaica, N. Y., which position he was holding at the time of his recent promotion to supervisor on the Pennsylvania.

F. A. Haley, transitman on the New York Central at Watertown, N. Y., has been promoted to assistant supervisor at Malone, N. Y., succeeding **F. H. Holloway,** who has been transferred to the Mohawk division, with headquarters at West Albany, N. Y., to succeed **J. E. Conerty,** who has been appointed bridge and building inspector at Albany, N. Y. **L. H. Johnson,** extra gang foreman and assistant supervisor on the Pennsylvania division, with headquarters at Mahaffey, Pa., has been appointed assistant supervisor on the Buffalo division, with headquarters at East Buffalo, N. Y., to succeed **E. J. Graney,** who has been promoted to supervisor on the Adirondack division with headquarters at Remsen, N. Y., where he succeeds **G. B. Baerthlein,** who has been transferred to the River division, with headquarters at Kingston, N. Y. Mr. Baerthlein succeeds **C. H. Morse,** who has been promoted to general inspector of track in the office of the engineer maintenance of way, with headquarters at New York, to succeed **H. I. Hoag,** whose promotion to division engineer of the Rochester division is noted elsewhere in these columns.

M. W. Brown, section foreman on the Hannibal division of the Chicago, Burlington & Quincy, has been promoted to roadmaster on that division with headquarters at Hannibal, Mo., succeeding **D. Cameron,** who has resigned to become service engineer of the Chipman Chemical Engineering Company, Inc., with headquarters at Chicago. **E. A. Warner,** assistant roadmaster on the Ottumwa division, has been promoted to roadmaster on the Hannibal division with headquarters at Burlington, Iowa. The headquarters of **J. R. Kanan,** roadmaster on the Hannibal division, have been changed from Old Monroe, Mo., to St. Louis and his jurisdiction has also been changed to include the territory formerly under the jurisdiction of **J. A. Walker,** who has been assigned to other duties.

P. C. Laigh, assistant supervisor on the Baltimore & Ohio at Rockwood, Pa., has been promoted to supervisor, with headquarters at Parkersburg, W. Va., to succeed **J. G. Collinson,** who has been transferred to Meyersdale, Pa. **C. Sole,** has been appointed supervisor, with headquarters at Washington, Pa., to succeed **J. W. Kimmons,** who has been transferred to West Newton, Pa., succeeding **R. L. Schramm,** deceased. **E. H. McDargh,** supervisor, with headquarters at Ravenswood, W. Va., has been transferred to Rowlesburg, W. Va., to take the place of **M. W. Laffey,** who has been transferred to Piedmont, W. Va., to succeed **T. A. Laffey,** deceased. **A. C. Browning** has been appointed supervisor, with headquarters at Toledo, Ohio, succeeding **F. A. Jones,** who has been transferred to Hamilton, Ohio.

H. C. Paton, assistant on engineer corps on the St. Louis division of the Pennsylvania, has been promoted to assistant supervisor at Terre Haute, Ind., to replace **H. F. Beard,** who has been promoted to supervisor, with headquarters at Richmond, Ind., to succeed **F. I. Hale,** who has resigned. **R. W. Riser,** assistant supervisor at Morrow, Ohio, has been promoted to supervisor at Richmond, Ind., succeeding **W. O. Wolfe,** who has been granted a leave of absence. **M. E. Hood,** assistant on engineer corps on the Cincinnati division, has been promoted to assistant supervisor at Williamsport, Pa., **J. L. Hetz,** assistant on engineer corps on the Columbus division, has been promoted to assistant supervisor at Pottsville, Pa. **H. B. Sutherlin,** supervisor at Valparaiso, Ind., has been transferred to Grand Rapids, Mich., succeeding **D. Lynch.**

P. C. Smedley, whose promotion to supervisor on the Long Island, with headquarters at Hicksville, N. Y., was noted in the May issue, was born on March 25, 1895, at Media, Pa. On February 14, 1917, he entered the service of the Pennsylvania as a chainman in the division engineer's office at Altoona, Pa., and later became a fourth-year draftsman. From February 5, 1919, to May 13, 1920, he was on furlough due to force reduction on the Pennsylvania, and during this time he was connected with the Baldwin Locomotive Works. From December 1, 1921, to May 16, 1922, he was again furloughed, and was temporarily employed in the office of the city engineer of Altoona, Pa. Returning to the Pennsylvania in May, 1922, Mr. Smedley entered the construction department, in which he held various positions until July 5, 1927, when he was made assistant supervisor at New York. He was holding this position at the time of his recent promotion to supervisor on the Long Island, now a part of the New York zone of the Pennsylvania.

Carl H. Burgess, roadmaster on the Yellowstone division of the Northern Pacific, at Glendive, Mont., has been promoted to division roadmaster of the Dakota division, with headquarters at Jamestown, N. D., to succeed **W. G. Ashworth,** who has been transferred to the Tacoma division to replace **Robert G. Knight,** who has been promoted to trainmaster-roadmaster on the Fargo division, succeeding, as roadmaster, **Raymond W. Davis,** who has been transferred to Glendive to succeed Mr. Burgess. **Frank G. Cook,** division roadmaster of the Yellowstone division, with headquarters at Glendive, Mont., has been appointed trainmaster-roadmaster on the Rocky Mountain division, with headquarters at Wallace, Idaho, succeeding **Morton Webster,** who has retired. **Marquis L. Hare,** roadmaster on the Seattle division, with headquarters at Lester, Wash., has been promoted to division roadmaster of the Yellowstone division to succeed Mr. Cook. **Alfred E. Perlman,** roadmaster on the Dakota division, at Jamestown, N. D., has been transferred to the Idaho division, at Kootenai, Idaho, to succeed **Albert H. Smyth,** who has been transferred to Lester, Wash., to succeed Mr. Hare. **Cecil W. Hildebrandt,** acting roadmaster at Centralia, Wash., has been promoted to roadmaster, with the same headquarters.

Bridge and Building

G. C. McCue, bridge and building master on the Canadian National, with headquarters at Hamilton, Ont., has been transferred to London, Ont., to succeed **W. Tichbourne,** who has retired on a pension.

A. E. Botts, whose promotion to general supervisor of bridges and buildings on the Chesapeake & Ohio, at Richmond, Va., was noted in the May issue, was born on July 15, 1882, at Bethel, Ky., and was educated at Kentucky State University. He entered railway service with the C. & O. as a rodman on November 1, 1906, and in April, 1908, was promoted to assist-

ant engineer. In November, 1912, he was appointed supervisor of track, and in October, 1914, he was promoted to division engineer at Huntington, W. Va., which position he was holding at the time of his recent promotion to general supervisor of bridges and buildings.

L. J. Kennedy, master carpenter on the Cresson division of the Pennsylvania, with headquarters at Cresson, Pa., has been transferred to the Middle division, with headquarters at Altoona, Pa., succeeding **R. McKibben,** who has been transferred to Cresson to succeed Mr. Kennedy.

William F. Bucknell, whose promotion to supervisor of bridges of the Chicago, Burlington & Quincy, Lines West of the Missouri River, was noted in the May issue, was born on August 13, 1873, at Milford, Mich., and entered railway service with the Burlington in May, 1896. After serving as a roundhouse helper at Wymore, Neb., in 1902, he became a bridge carpenter on the St. Joseph division in 1903 and was promoted to concrete foreman in 1905. In 1907, he was general bridge foreman on relocation work between Waldron, Mo., and Beverly, returning to the St. Joseph division as bridge foreman the same year. He later served in the same capacity on various divisions of the road until January 1, 1924, when he was promoted to master carpenter of the Creston division at Creston, Ia., which position he was holding at the time of his promotion to supervisor of bridges of the lines west of the Missouri river.

Water Service

W. S. McCaleb, engineer of water service of the Pennsylvania system, has been promoted to general superintendent of water service, with headquarters, as before, at Philadelphia, Pa., **J. A. Russell,** engineer of water companies, has been promoted to engineer of water service to succeed Mr. McCaleb.

Mr. McCaleb was born on May 18, 1862, at Mt. Pleasant, Pa., and was educated at Mt. Pleasant Institute. He entered railway service in March, 1880, as a rodman on the Pennsylvania and was later promoted to assistant supervisor and supervisor, which positions he held at various points. He was promoted to division engineer at Pittsburgh, and later was transferred to Harrisburg, Pa. In 1895 he was promoted to superintendent of the Bedford division, with headquarters at Bedford, Pa., and from 1903 to 1917 he served in this capacity on the Sunbury and Shamokin division, the Middle division, and the Philadelphia division. In 1917, he was appointed engineer of water service and also general superintendent of the Pennsylvania Water Companies, at Philadelphia. He will continue to hold the position of general superintendent of water companies in addition to that of general superintendent of water service.

Mr. Russell was born on February 6, 1887, at Philadelphia, Pa., and was educated at the University of Pennsylvania. He entered the employ of the Pennsylvania Water Companies on July 1, 1913, as an assistant engineer, and on March 1, 1925, he was promoted to engineer of water companies, which position he continues to hold in addition to that of engineer of water service.

Purchasing and Stores

E. G. Wangelin has been appointed purchasing agent of the Illinois Terminal System, with headquarters at St. Louis, Mo., succeeding **H. J. Vance,** who retains the position of purchasing agent of the Chicago & Illinois Valley, a subsidiary, with headquarters at Decater, Ill.

E. J. Clark, storekeeper on the Chicago, Burlington & Quincy, at Creston, Iowa, has been promoted to chief lumber inspector, with headquarters at Chicago, to succeed **F. S. Shinn,** whose appointment as special agent of the Curtin-Howe Corporation, New York. was noted in the May issue. **G. J. Simbleman** has been appointed storekeeper at McCook, Neb., to succeed **R. A. Schuff,** who has been transferred to Lincoln, Neb., to replace **C. H. Grometer,** who, in turn, has been transferred to Creston to succeed Mr. Clark.

Obituary

William J. Byrne, who was supervisor on the Boston & Maine at Mechanicsville, N. Y., at the time of his retirement in 1927, died at his home at that place on March 29. Mr. Byrne entered railway service at the age of 16 years on construction work on the Hoosac tunnel and was promoted successively to section foreman and supervisor. He had been in the employ of the Boston & Maine and its predecessor company for 57 years at the time of his retirement.

Pierce J. Landers, superintendent of the Indianapolis Union, with headquarters at Indianapolis, Ind., died in that city on May 25 from heart disease. He was born on July 17, 1870, at Indianapolis and entered railway service in July, 1888, as a rodman on the Pennsylvania, later serving successively as superintendent's clerk, as a draftsman and as an assistant engineer. From 1898 to 1907 he acted as roadmaster at Oshkosh, Wis., and division engineer at Fond du Lac, Wis., on the Wisconsin Central (now part of the Minneapolis, St. Paul & Sault Ste. Marie) and as assistant engineer on the Indianapolis Union. Mr. Landers was then promoted to engineer maintenance of way of the same railroad, and was further promoted to superintendent on August 1, 1916.

John D. Isaacs, consulting engineer of the Southern Pacific at the time of his retirement from active service in 1923, died at his home in San Francisco, Cal., on April 26. Mr. Isaacs was born at Richmond, Va., on October 6, 1848, and was educated at the University of Virginia, where he graduated in 1870. After several years as a machinist's apprentice at Baltimore, Md., and Wilmington, Del., he entered railway service on March 1, 1875, as a draftsman in the maintenance of way department of the Southern Pacific, with which system he was identified until the time of his retirement. After advancing successively to chief draftsman, assistant superintendent of bridges and buildings and superintendent of bridges and buildings, he was promoted to second assistant engineer maintenance of way of the Pacific system, with headquarters at San Francisco. Following the merging of the Southern Pacific and the Union

John D. Isaacs

Pacific in 1904, Mr. Isaacs was promoted to consulting engineer on December 1, 1905, in matters relating to the construction and maintenance of bridges and buildings, signaling and timber preservation, with headquarters at San Francisco. His headquarters were removed to Chicago in 1907 and later to New York. After the dissolution of the merger of the Southern Pacific and the Union Pacific, he resigned as consulting engineer of the latter system and continued as consulting engineer of the Southern Pacific until his retirement in 1923. Mr. Isaacs was one of the pioneers in timber preservation and in 1892, in co-operation with W. F. Curtis, invented a portable timber-treating plant. He was the inventor of the taper rail to do away with compromise joints, and, in conjunction with J. B. Speed, he was the inventor of a rifled pipe line.

A. Munster, who was bridge engineer and chief engineer of the Chicago Great Western from 1900 to 1906, died at his home in Seattle, Wash., on May 13 at the age of 75 years. Mr. Munster was born at Bergen, Norway, and came to the United States in 1882, entering the service of the Northern Pacific as a draftsman and later serving as a typographer and transitman with that road. In 1900 he was appointed bridge engineer of the Chicago Great Western at St. Paul, Minn., and in March, 1904, was promoted to acting chief engineer at the same point, being promoted to chief engineer in April of the following year. He retired on July 1, 1906.

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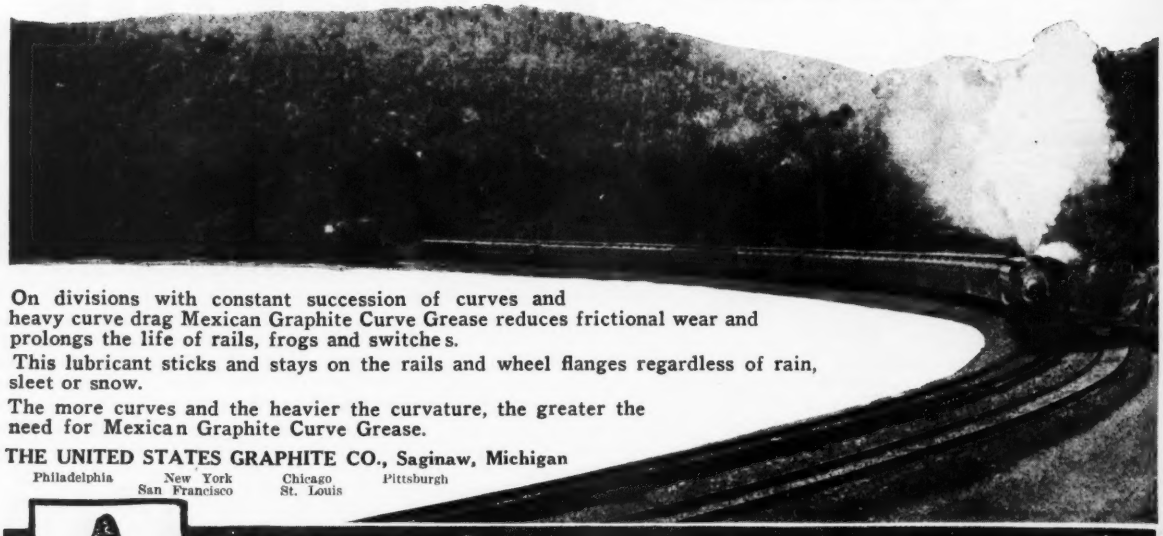
P-R-O-L-O-N-G *the Life of Rails on Curves*



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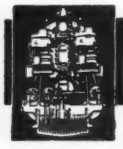
By W. F. RENCH, formerly Supervisor on Pennsylvania Railroad



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1. The Relining of Curves with a String.
2. Preliminary Study of the Curve.
3. The Solution of String Lining Problems.
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8. Essential Elements in the Design of Switch Connections.
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10. Rules for Various Functions of Turnouts.
11. Practical Considerations in Installing Turnouts.
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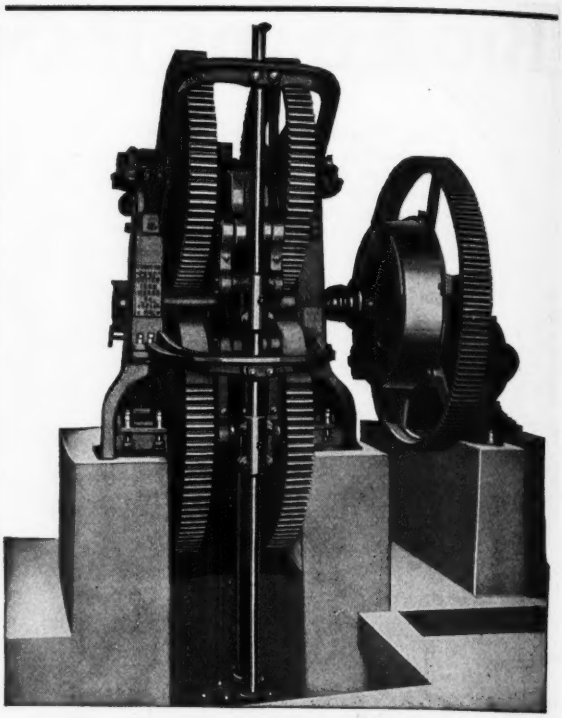

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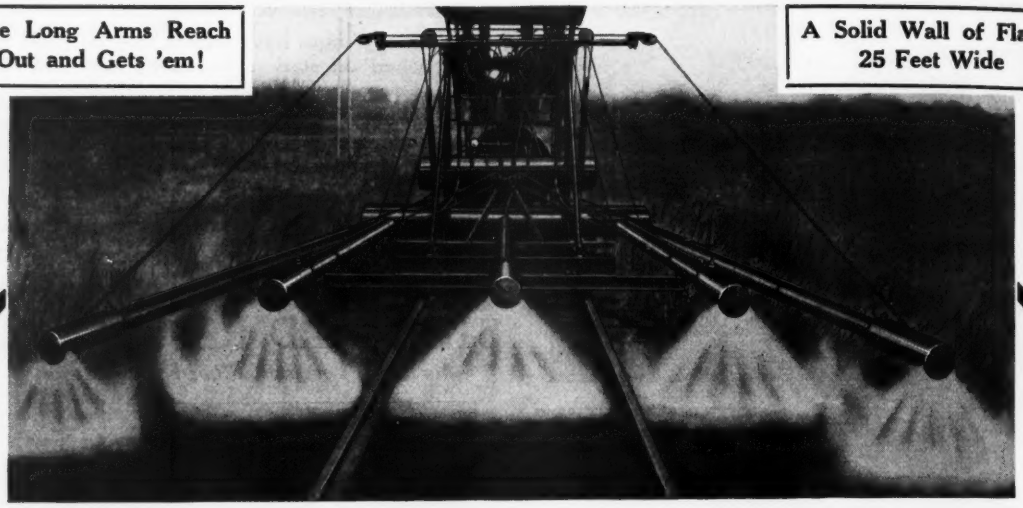

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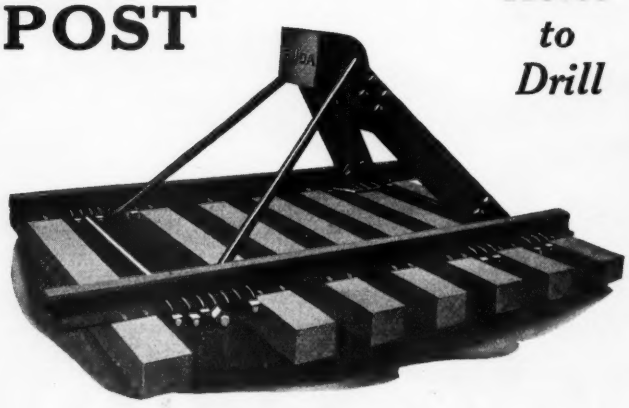

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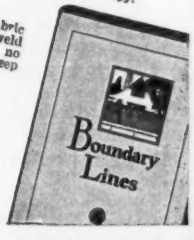

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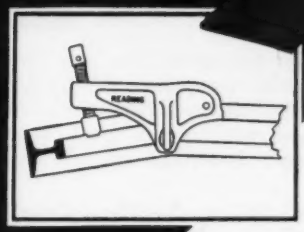

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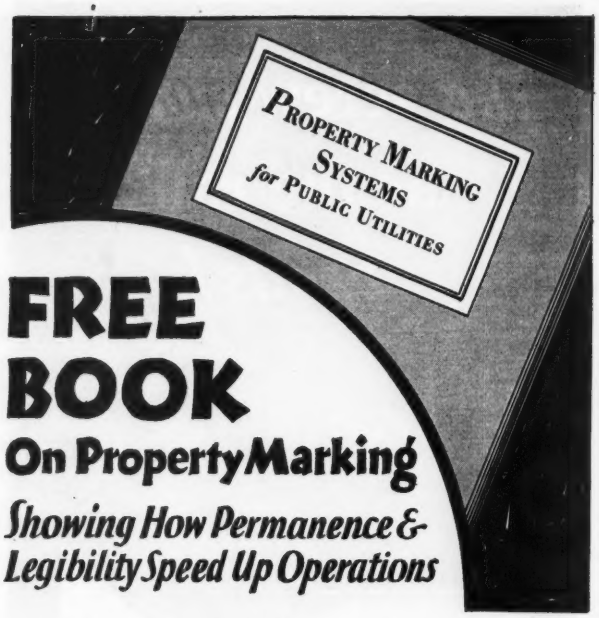

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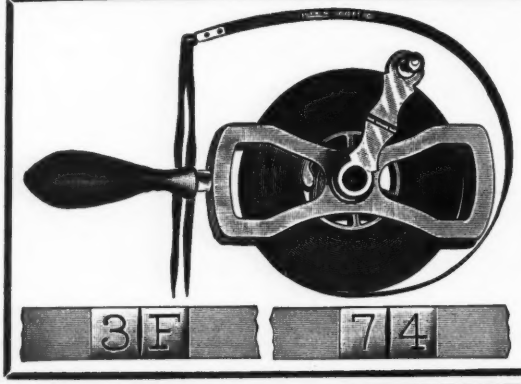

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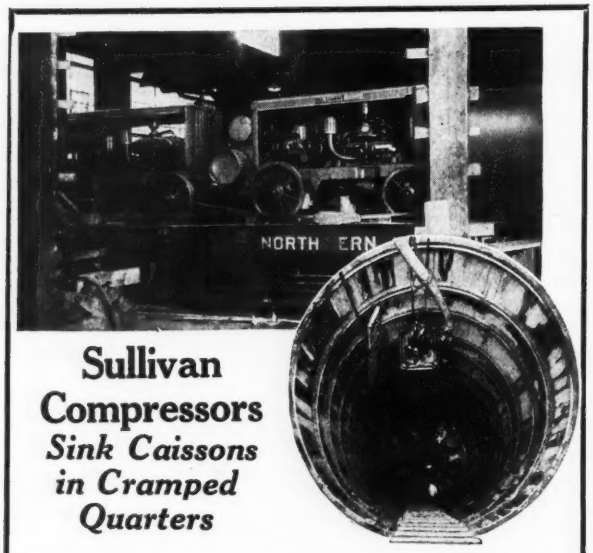

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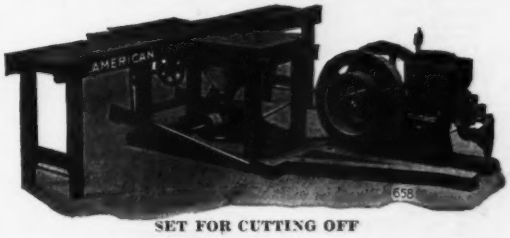

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Fairmont Railway Motor Co.
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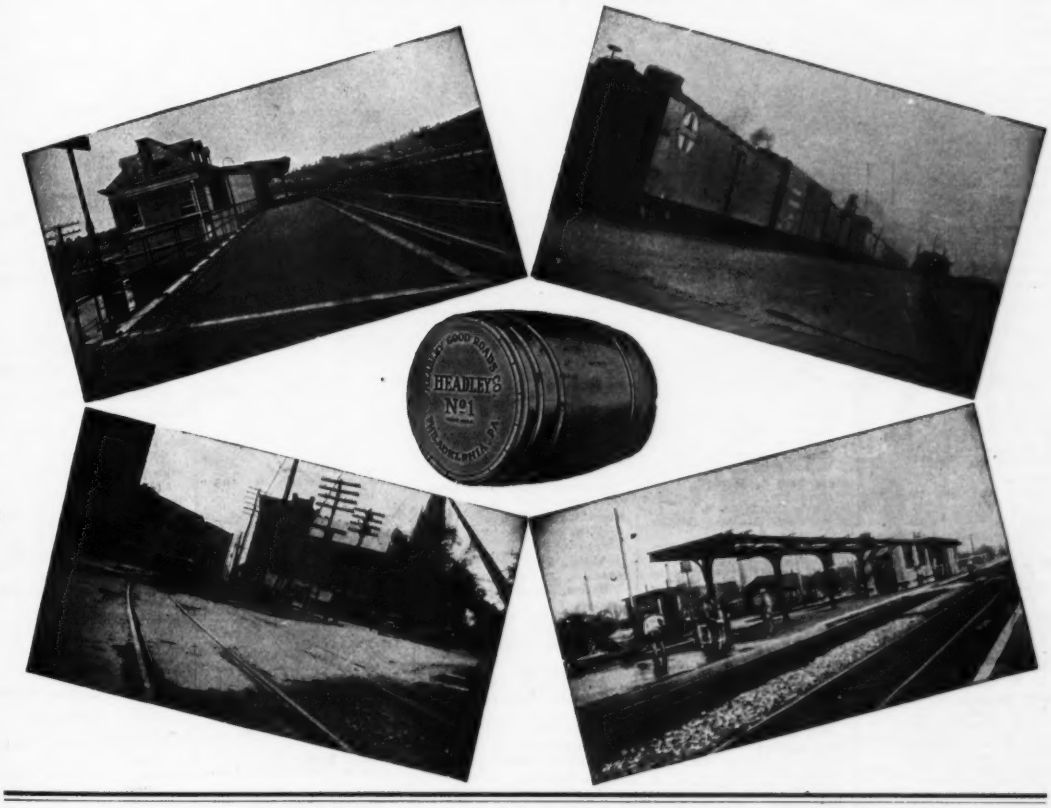

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Massey Concrete Products Corp.

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Illinois Steel Company

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Armco Culvert Mfrs. Assn.

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Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

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Ingersoll-Rand Co.

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Waterproofing Asphalt
Carey Co., Philip

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Carnegie Steel Co.

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American Saw Mill Machinery Co.

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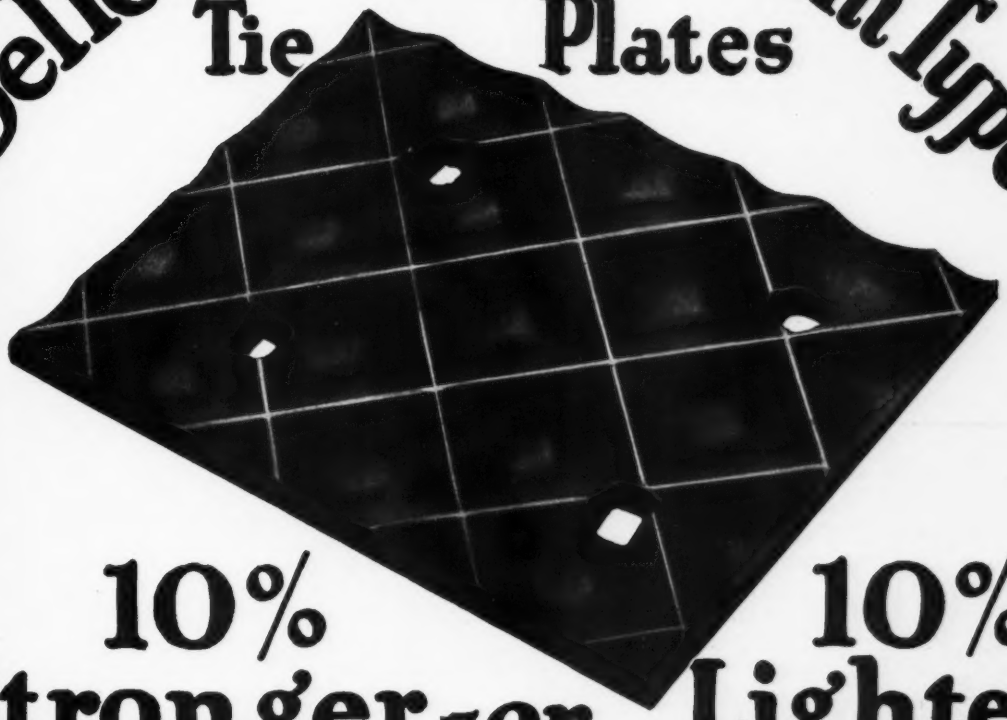

10% Stronger -or 10% Lighter

The first improvement in tie plate construction came from SELLERS—the SELLERS ANCHOR Bottom which protects the tie, instead of the flange bottom which mutilated the tie.

Now we have still further perfected this design, by making each grid arch-shaped instead of flat.

A SELLERS Wrought Iron Arched Bottom Tie Plate will support a load more than 10% greater than a tie plate of the same weight in flat bottom designs. Many railroads have shown prompt approval by changing specifications to SELLERS Wrought Iron Arched Bottom Tie Plates.

SELLERS MANUFACTURING COMPANY

ILLINOIS MERCHANTS BANK BLDG., CHICAGO, ILLINOIS

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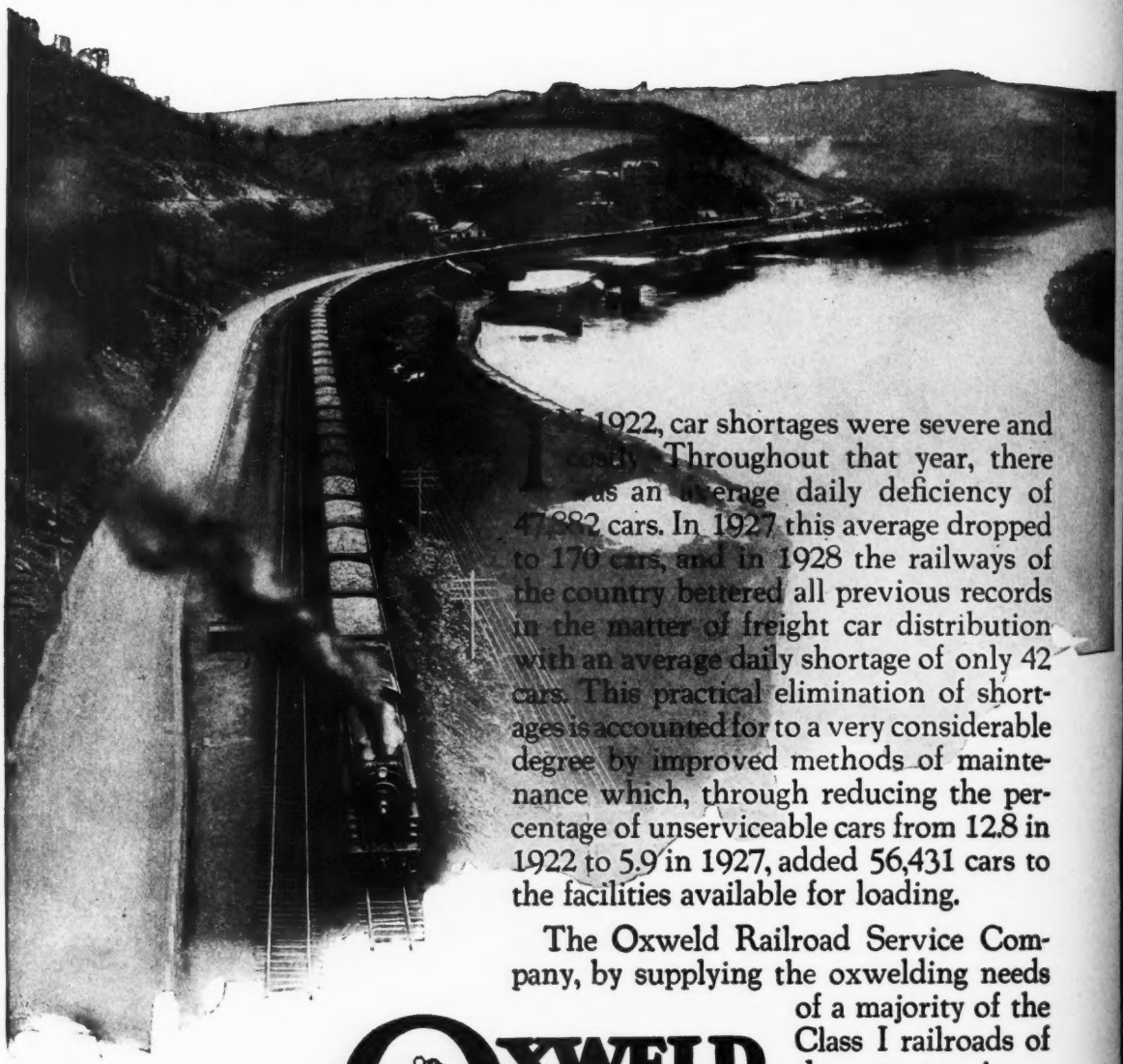

In 1922, car shortages were severe and costly. Throughout that year, there was an average daily deficiency of 47,882 cars. In 1927 this average dropped to 170 cars, and in 1928 the railways of the country bettered all previous records in the matter of freight car distribution with an average daily shortage of only 42 cars. This practical elimination of shortages is accounted for to a very considerable degree by improved methods of maintenance which, through reducing the percentage of unserviceable cars from 12.8 in 1922 to 5.9 in 1927, added 56,431 cars to the facilities available for loading.

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Unit of Union Carbide and Carbon Corporation

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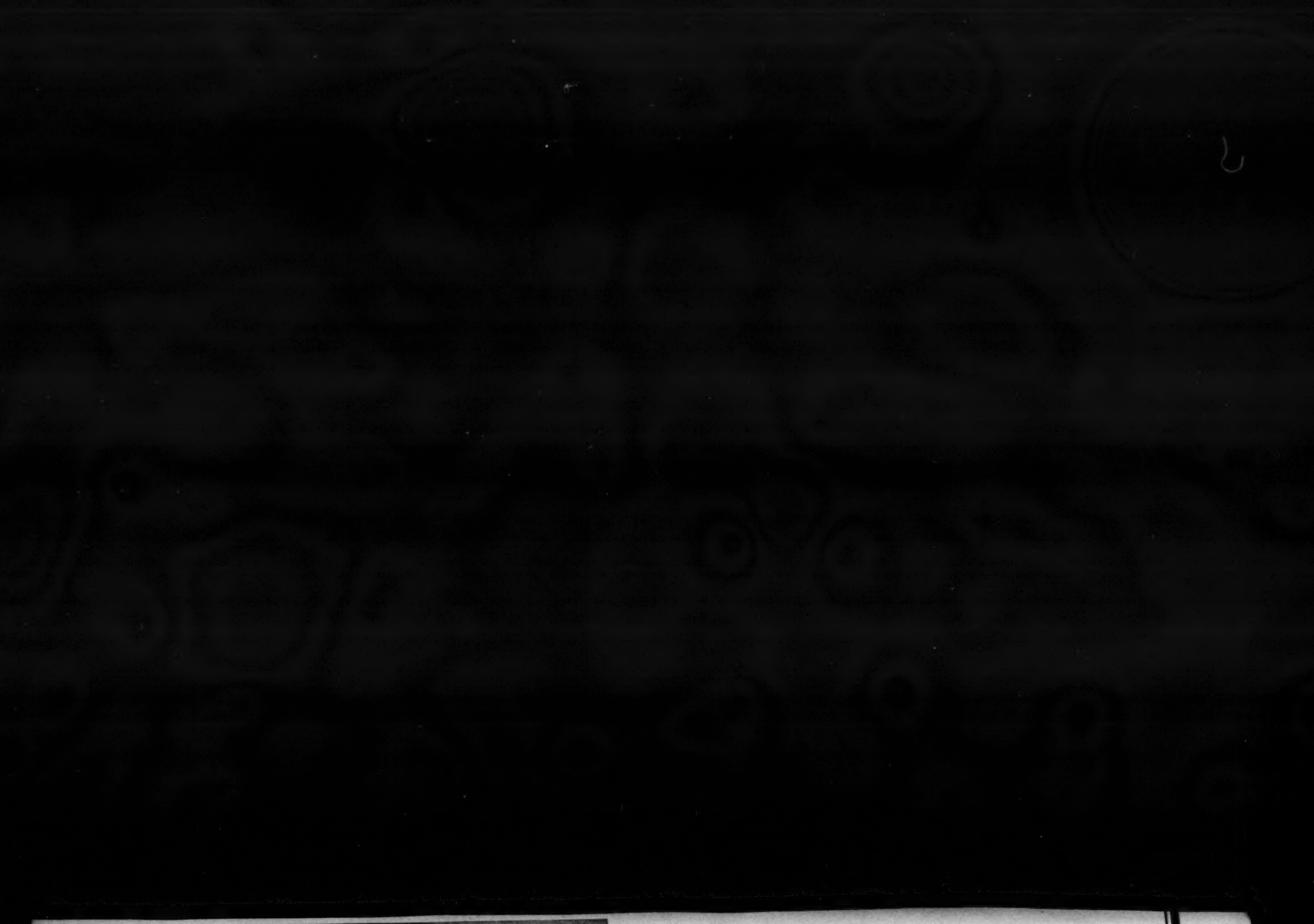
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